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BRITISH PHYCOLOGICAL BULLETIN

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* PHYCOLOGY AND THE BRITISH PHYCOLOGICAL SOCIETY

by Kathleen M. Drew.

PHYCOLOGICAL INVESTIGATION.

I believe the usual content of a talk labelled a Presidential Address is a survey of a certain field of knowledge with which the speaker is familiar. I am not an expert in these matters never having given a Presidential Address and having listened to a few only, and so pleading ignorance, I am intending to develop another line of thought. Rather than look back over a period of algal research, I intend to look forward and ask firstly, what should characterize algal investigations in the more or less immediate future and secondly, since this is the first Presidential Address to this Society, what part a Phycological Society can play in helping such investigations forward.

If for any reason an alga, whether it be a giant of the Pacific Ocean or a microscopic planktonic species of the sea or freshwater, attracts our attention, before long we are asking questions about it, questions to which it is quite likely we cannot find answers in the textbooks or if we can, experience teaches us to treat the information with caution. This last remark does not mean that I have not the greatest respect for the algologists of the last century and the earlier decades of this but they roamed over a tremendous field of endeavour at will and additions to knowledge came rapidly and easily. I suggest that the situation for us at the present time is entirely different. Among other things, our work has to be intensive rather than extensive and it has to be related to a very different general botanical philosophy. *So I further suggest that the time has come when satisfactory and really constructive progress in understanding these plants can only be made as the result of highly critical work stimulated by fresh concepts and fresh interpretations.*

If we look back over the accumulated fund of knowledge about the algae, while much is sound and much good work has been done, unfortunately there is also much which is certainly not critical even if it is accurate, and this one sometimes doubts. One finds evidence of a series of observations probably arranged in the inverse order when continuous observations would have shown the correct sequence of events; there are accepted generalizations based on very few examples or observations, e. g. statements about the place of reduction division are based on observations of the nucleus in a few sporangia belonging to a single plant; and finally there are accounts of life-histories in which half the information is treated as the whole story.

Similarly many concepts formulated decades ago are still in current use and moreover appear to be still accepted without question, even when new knowledge shows them to be inadequate. We know by experience that the material that we work with is difficult and demands exceptionally high qualities in the investigator but this makes it all the more necessary that in the first place our premises or basic concepts are by and large correct so that at the outset of investigations we ask the right questions and during the course of the investigations make the correct observations. I think these generalizations apply whatever type of investigation is being undertaken, whether it is work depending on observation or experiment. It applies to work of a taxonomic character, morphological work as well as work concerning reproduction and development, investigations of life-histories as well as to physiology, cytology and ecology. The need for critical work at the present time cannot be overstressed and even more rapid progress will result if fruitful concepts and interpretations are forthcoming.

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* This paper, read before the Society on January 4th. 1955, reports the first Presidential Address to be presented to the Society.

What part can the British Phycological Society play in meeting the needs I have outlined? I think the need for discussion of observations, results of experimental work, methods, concepts, etc., concerned primarily with the algae, was one of the main reasons - if not **the** main reason - for calling that first meeting at Bangor just over three years ago. It was called with some hesitancy but the response was surprisingly good and so I think it safe to conclude that the need for such discussion was felt generally by the algologists of the country. Out of that meeting, the British Phycological Society has grown and now that the work of organizing the Society is done, the time has perhaps come when we can give more time to considering the policy and aims of the Society. In the first circular, this aim was then expressed as "the encouragement of critical and experimental work on the algae" and I take this to mean essentially what I started by saying should characterize all algal investigations, namely that they must record accurate information, which in its turn must be accurately interpreted. I hope this still is and will remain our main aim and that we shall see that the meetings we organize further this aim by the type of programme we plan and the quality of work we encourage.

Enough generalizations. I should like in the next few minutes to illustrate what I have been saying by examples, i.e. the need for highly critical work and fresh interpretations. I hope you will forgive me if the examples are drawn from the Bangiophycideae group of algae, familiar to me at the moment. I make no claim to originality in what I say and I am sure many of you could give similar examples and must have reached the same conclusions.

Before going on to these examples, I should like to digress to recommend the preparation of reviews recording the present state of our knowledge of either one group of plants or a special topic of interest. I hope the Society will encourage and sponsor such reviews. Well prepared reviews are helpful in several ways to the writer as well as the readers. The evidence from the original papers is reassessed, and this often reveals that the generalizations of the text-books are not correct or ill-founded. It may be found that the evidence is old and the conclusions drawn from it, while legitimate at the time, would no longer appear so in the light of the development of general botanical thought. Secondly, such reviews are helpful in that they provide a sort of balance sheet indicating the gaps in our information and where work is particularly needed. Thirdly, if we compare the information provided in such reviews with similar ones in other branches of Botany, the evidence accepted in our branch of the science is not generally speaking up to the standards required in many others.

EXAMPLES TO ILLUSTRATE THE NEED OF CRITICAL INVESTIGATIONS.

A - TAXONOMY.

My first examples concern taxonomy. It is generally known that there is great need of taxonomic work in the Algae, work important for its own sake and as the basis of many other types of work. It is not easy to find reliable and adequate descriptions of many of the common marine species of the British Isles although we have improved on the original description of *Callithamnion tetragonum*, for example, which was "red; much branched, branches four-sided". This was given by Withering in 1796. But vague comparative adjectives are used still in place of precise measurements, terminology is undefined and some workers place emphasis on some characters, whilst others choose different characters. One result of all this is that more than one taxon is passing under the same name. This is certainly the case with *Porphyra leucosticta* Thuret. Specimens passing under this name in European lists show far greater differences, as I have found recently, than two collections I made, one in the Isle of Man and the other on the coast of Maine. I think it likely that the varying concepts of *P. leucosticta* are possibly the result of what one might call inherited knowledge, that is the name for a given taxon was acquired from a teacher of an earlier generation, rather than from a good description. But it is also the result of identification on the basis of a single character. In the case of *P. leucosticta* this is the occurrence of the spermatia in scattered patches on the thallus instead of in continuous bands around the edge of the thallus, the distinguishing character noted by Thuret (in Le Jolis, 1863) when describing the species for the first time. Until there are good descriptions, there is bound to be such mis-identification, such as I have illustrated in the case of *P. leucosticta* and it is not difficult to see what false conclusions may be reached regarding questions of distribution and ecology, if answers are based on lists containing such mis-identifications.

When such a range of specimens are found to be passing under the same binomial at least two questions have to be answered:- 1) to what specimen did the binomial first apply and 2) what are the limits of the taxon? I have not attempted to answer this second question yet as far as *P. leucosticta* is concerned but it is clear that it would be necessary to collect as great a range of specimens as possible from different latitudes, different habitats and at different times of year in order to ascertain what range of form and colour occurs. If there is a range of form and so on it is then desirable to attempt to establish whether this is due to genotypic or phenotypic causes. Methods used in other groups of plants might well be applied to the solution of these problems in the algae. As regards an answer to the first question, I had the opportunity when I was in Paris last summer of seeing the specimens which Thuret named in his description of the species and so a description based on similar material is now possible.

I should like to add in parenthesis that the search for the nomenclatural type of a taxon, the specimen to which the specific epithet was first applied, is not often as short and simple as that for *P. leucosticta* was, where I was able to see all the three specimens referred to in the original description. *P. umbilicalis,* a Linnean species provides an example. In the first edition of the Species Plantarum, (1753), *Ulva umbilicalis* is described as "Ulva fronde dilata, subsinuata, centro radicata", and such a brief description makes a specimen all the more desirable. There is no figure and there is no specimen in the Linnean herbarium designated *Ulva umbilicalis* by Linnaeus. Someone other than Linnaeus has written this binomial on a sheet on which there are two crumpled specimens of a species of *Porphyra* collected at the Cape of Good Hope and there is other cirumstantial evidence suggesting that Linnaeus may never have seen these specimens himself. However, further help in determining the taxon Linnaeus had in mind, is available. Linnaeus refers to a figure of Dillenius (1740) and on reference to Linnaeus' own copy of this work, there underneath the figure, in what is usually accepted as Linnaeus' own hand-writing, is the binomial *Ulva umbilicalis.* To me this figure is a sufficiently clear representation of a plant to be found on the European coasts as to remove all doubt of the identity of typical specimens. This is fortunate as I learnt on enquiry that the folder in the Dillenian herbarium at Oxford and bearing the appropriate name is now empty. Other searches may never yield conclusive information. For example, I still am in considerable doubt as to what taxon Lightfoot (1777) applied the binomial *Ulva laciniata,* now *P. laciniata* (Lightf.) Ag. and I doubt whether this can ever be discovered with certainty. There is evidence in favour of considering the type specimen as lost, (if indeed there ever was one) and in addition the description and figures raise doubts in my mind as to whether the alga being described was a species of *Porphyra* as we understand it to-day. It seems more like a member of the Delesseriaceae. This uncertainty is particularly unfortunate since this species of Lightfoot is the first listed by Agardh (1824) in his genus *Porphyra.*

It would be possible to go on multiplying such examples indefinitely but the point I wish to make is that the Society is playing and can continue to play a very useful part in helping to clear up the confusion which exists in algal nomenclature. Individual members are working on such problems and in addition I am sure that members of our Sub-committee on Nomenclature are willing to help those of us who are inexperienced in these matters. It would also be useful if this sub-committee keeps a watch on how the International Rules of Botanical Nomenclature work when applied to the Algae.

I have been showing by reference to *Porphyra leucosticta,* what need there is for good descriptions of individual species and for consideration of criteria for delimiting species. This applies with equal force to genera, families and so on. At present these groupings are based on opinion rather than on either defined principles or intensive work in many instances. When working on the Pacific Coast species of Naegeli's genera *Acrochaetium* and *Rhodochorton,* I failed to find any clear and consistent dividing line and being inexperienced I put the two genera together, knowing however that this arrangement would not be final. However, recently and more or less simultaneously, Papenfuss (1945, 1947) and Kylin (1944) both grouped these algae into four genera, but the four fresh genera are not identical. I think this shows that the true groupings have still to be found.

The classification of the Florideae is unsatisfactory as regards major groupings but confusion may well result if piecemeal changes are made while it is still not clear which characters are of major importance for phylogenetic and diagnostic purposes. Feldmann (1952) has separated the Acrochaetiaceae as a separate Order, on the basis that there is no carpogonial branch. However, there is no carpogonial branch in *Polyides caprinus* (Rao, unpub.), *Gelidium latifolium* (Kylin, 1923), *G. crinale* and *G. latifolium* (Dixon, unpub.) and so that character alone can hardly be sufficient reason for the separation of the Acrochaetiales from the other Nemalionales. M. and Mme. Feldmann (1942) have separated two genera of the Bonnemaisoniaceae, *Asparagopsis* and *Bonnemaisonia* into a separate Order, the Bonnemaisoniales, on the basis of the occurence in the life-history of a tetrasporophyte, morphologically different from the gametophyte. These two genera are therefore separated from two imperfectly known Australian genera, *Leptophyllis* and *Delisia,* which Levring (1953) would leave in the Bonnemaisoniaceae. It may be demonstrated eventually that morphologically simple phases occur in these genera also in addition to tetrasporophytes resembling the gametophytes which are known to occur in certain species of *Leptophyllis* and *Delisia.* Fundamental issues are involved here and I suggest we are not yet in a position to settle the taxonomic questions.

It would seem best therefore to continue to use Kylin's (1937) classification, while aware of its imperfections, until sufficient evidence based on investigations with this object in view, make definite proposals for an altered classification justifiable.

What can the Society do to further this taxonomic work? Naturally as in much else, much depends on the work of individual members but probably a combination of both individual and co-operative effort is the best solution. The sub-committee for the Marine Algal Check-List and Flora is sponsoring work in connection with a new Flora, which will naturally include descriptions of species based on critical work as far as possible, but it also wishes to encourage the preparation of longer accounts of certain species selected by individual workers and to be rather on the lines of those published in the Journal of Ecology for flowering plants. These will be published separately as ready and we cannot have too many volunteers for the work. Some such descriptions will be comparatively straightforward but others will involve the solution of taxonomic or nomenclatural problems or quite often both.

It would probably be helpful to those undertaking such work if the Society could organize symposia, for larger or smaller groups, on problems with which members attempting such work would have to grapple, such as terminology, criteria for the separation of taxonomic units, to mention but two.

B - LIFE-HISTORIES.

Turning now to quite a different branch of the subject, life-histories of the algae. One of the most outstanding characteristics of the algae is the variety shown by their life-histories. If the currently accepted generalizations are examined however, they are found to be based on very scanty information and there are many recorded facts which do not fit the generalizations. Indeed it would be difficult to find another branch of Phycology where there is greater need for critical information as well as fresh interpretations.

If the need for critical information is considered, first, what is the least information that should be considered adequate before it can be stated that the life-history of an alga is known? Starting with a spore, I suggest that we need to ascertain:- 1) the morphology of the thallus that develops from that spore, whether it resembles the parent or not, 2) the type of reproductive bodies formed on the thallus, 3) whether they vary according to age or external conditions, 4) whether spores apparently similar always germinate in the same say, 5) if different spores are produced, what type of thallus develops from each, the reproductive bodies they bear and so on. Three pieces of cytological information are also essential, firstly, the place of karyogamy, secondly, the place of meiosis and lastly but quite as important, the chromosome complement of thalli bearing known reproductive bodies in different areas and at different times of year.

This I am aware is counsel of perfection and the plant is likely to do something quite unexpected while one's attention is not on it. I know too that there are few if any algae, for which all these questions have been answered although in groups with stereotyped life-histories, we can feel reasonably satisfied. While realized ignorance on such points can be remedied, it is very difficult to get corrected statements into the text-books and to indicate that life-histories are incompletely known in many cases.

One aspect of the life-histories of *Porphyra* and *Bangia* provides a good example of this sort of thing. It is generally stated in the text-books that they are haplonts, reduction division occurring immediately after fertilization and karyogamy. In so far as some investigators look upon this group of algae as the Protoflorideae, a view with which I cannot say I am in agreement, they see in this an argument for supposing that the primitive Florideae were, or are, those which are haplonts also. What evidence is there for the statement that the Bangiophycideae are haplonts? Evidence of fertilization and reduction division has to be established. First of all with regard to fertilization. it is necessary to begin by identifying the sexual cells and this proves difficult. It is known that certain cells of *Bangia* and *Porphyra* divide up repeatedly to form small colourless cells, which are usually accepted as spermatia. On the other hand it is very difficult to identify the female gametes. Some of the earlier observers thought that fertilization took place between the liberated spermatia and other liberated spore-like cells and in more recent times this view received some support from Knox (1926) studying *P. naiadum* in the Puget Sound region. The cells considered female gametes by Knox are formed in the same manner as the spermatia, that is by repeated divisions of a mother-cell. On the other hand, Berthold (1882) and several investigators since his time consider these same cells or spores as carpospores. The similarity of the pigments made it natural for Berthold to compare these algae and the Florideae and therefore to search for the female cell *in* the thallus and for fertilization to take place *in situ*. A careful examination of the existing accounts of fertilization *in situ* shows an exceptional variation of detail however and even in a single account, two methods are frequently either described or figured (1). In the first type, the female cell shows a prolongation to which the spermatium becomes attached and in the second there is no prolongation of the female cell but the so-called spermatium puts out a long and very fine tube which traverses the mucilage and finally reaches the female cell. It should be added that Berthold states (and others after him) that the fine tube connecting the spermatium so assumed, and the carpogonium, as it is called, is to be seen much more clearly if glycerine be added to the living material. Others suggest that this fertilization process is to be seen more frequently after the material has been kept in the laboratory for a few days. These facts suggest the need for further critical work.

Berthold considered that the zygote of *Porphyra* divided up within its own cell wall to form eight or more spores, the first dividing wall being parallel to the surface of the thallus. This sub-division of the zygote resembles the division of the mother-cell to form the spermatia. This fact raises doubts about the interpretation and another point which raises doubts in my mind is that in *P. umbilicalis* var. *laciniata* at any rate, such "packets" of spores develop in continuous bands around the edge of the thallus. On Berthold's interpretation this presupposes that all cells are carpogonia and that all carpogonia are fertilized.

The interpretation of these "packets" of spores as carpospores has led to difficulty of distinguishing them from monospores, a difficulty acknowledged by writers themselves familiar with the Bangiophycideae. In his endeavour to escape from this dilemma, Kylin (1945) got into a still more difficult position. Implicitly accepting Berthold's statement, he concluded the way to distinguish carpospores from monospores was to germinate them, thus assuming what has never been proved, namely that spores formed in "packets" germinate to give creeping filaments while the monospores germinate into thalli similar to those on which the spores had been formed. It has long been known that spores formed from the entire contents of the mother-cell of *Bangia* germinate into a filament similar to that from which the spore arose and there is some slight evidence that the same is true of *Porphyra*, and there has never been any suspicion that such spores have any sexual function. On the other hand, those formed in "packets" from a single mother-cell, (and here the evidence comes mainly from *Porphyra*) germinate to give the *Conchocelis*-phase. It seems to me that this is as far as we can go and that we are not yet in a position to state the nature of these spores which are formed in "packets" from a single mother-cell, formed, be it noted, in exactly the same way as spermatia. The evidence of fertilization appears to be still inadequate and open to criticism. I might add in parenthesis that the evidence of sexual reproduction is hopelessly inadequate in the other genera of the Bangiophycideae for which it has been reported. While I cannot make any positive contribution to the solution of this question of fertilization, you may be interested in two observations on the alga, which I refer to as *P. umbilicalis* var. *laciniata* for the present. On one occasion I found cells with protrusions of considerable size and in many instances from both sides of the cell, and with genuine spermatia adhering to them. Observation of these cells over some hours produced no evidence of the establishment of any open connection between these cells and the spermatia, however.

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(1) Schiller's figures for *B. atropurpurea* (1925) stand rather apart as the spermatium appears to have penetrated the mucilage and to be appressed to the protoplast of certain divided cells. No description accompanies the figure however.

The other observation concerns the suggestion that fusion may occur between liberated spermatia and liberated spores. In my experience few spores are amoeboid after liberation, but are usually round and have a clearly visible wall, whatever its chemical composition. In a recent collection of thalli, amoeboid spores were being liberated. Such spores have a very thin limiting layer, which allows the spores to pour out of a hole in the mother-cell wall as if semi-liquid and once out of the mother-cell the spore shows extraordinary changes of shape, although stationary. I should add that this is all amoeboid means, in this case, "Gestaltveranderung" of the German writers. Among the spores, I noticed small colourless bodies, which at first I took to be spermatia; and in addition similar bodies apparently attached to protuberances of the amoeboid spores. While watching one such amoeboid spore with a small rounded colourless body at the end of a protuberance of the spore, I saw the rounded body, the assumed spermatium, shot off and the spore rounded up immediately. Similar observations were made several times. Even though the presumed spermatium was shot off, it might still be postulated that fertilization had taken place. However, when undoubted spermatia were mixed with such amoeboid spores, no fusion took place and observation of very early stages suggests that the small rounded bodies, which are shot off, originate from the spore itself. Occasionally the protuberance is larger and contains a small portion of the chromatophore. Finally, Geitler (1944) has observed similar happenings in the aerial, unicellular alga, *Porphyridium cruentum*. So I doubt whether this is a fertilization process but it occurs and the explanation of these amoeboid spores and their curious behaviour will have to be found.

The cytological evidence of karyogamy and meiosis in support of the statement that *Porphyra* and *Bangia* are haplonts is that of Dangeard (1927) although recently Magne (1952) has doubted whether reduction division does take place immediately after fertilization. Further critical cytological work is needed in this group of algae before general statements about their cytological phases should be made.

This same alga, *Porphyra*, illustrates another point, namely that life-histories are accepted as established on the basis of insufficient evidence. Once the *Conchocelis*-phase was established (although I am still not clear about the nature of the spores from which it develops, unlike others who quote my work and state they are carpospores) it became necessary to establish how the leafy *Porphyra* develops from the *Conchocelis*-phase. What happens to the spores which develop in the fertile cell-rows? A Japanese worker Kurogi (1953a and b) who has repeated my work for four Japanese species of *Porphyra* considers he has found the answer. He obtained hundreds of thousands of spores over a period of a few months, on the bottom of each of three dishes in each of which he had suspended a shell infected with *Conchocelis*. He saw the first stages in the development of such spores. The oldest figured consists of a short row of quadrate cells, although longitudinal divisions are figured in the apical cell of one species. No figured germling has more than fifteen cells, the majority far fewer. This is taken to be sufficient evidence that here are germlings of the leafy *Porphyra* thalli and that the life-history is fully established. This takes no account of the evidence of the infection of sterile shells suspended in culture vessels containing heavily infected shells (Drew, 1954b) nor of the evidence of the development of small growths called "plantlets" in cultures of *Conchocelis* (Drew, 1954a). The largest of these being only just visible to the naked eye, the "plantlets" could very easily be missed on the surface of shells containing *Conchocelis*. Kurogi's spores may therefore have come from either fertile cell-rows of the *Conchocelis* or from "plantlets" and I suggest that until such germlings as Kurogi obtained have been cultured much further, the nature of the thalli to be formed and the life-history remains incompletely known.

NEED OF FRESH INTERPRETATIONS OF LIFE-HISTORIES.

As a branch of the study of the algae, where fresh interpretations are needed, it would be difficult to find a better example than that of life-histories. The amount written on this subject is in great contrast with the amount of critical information available. In addition, elaborate theories of phylogeny have been based on the little we know. I have recently elaborated on this theme at some length (1954c) and so I will confine my remarks to-day to adelophycean phases. This type of somatic phase, a phase to be found in the life-history of many algae, provides an excellent example of the need for fresh interpretations and concepts. The literature to say the least is confusing to the experienced, much less the inexperienced, reader.

These adelophycean phases are usually considered in the light of a theory which (1) supposes a regular alternation of haploid and diploid nuclear phases, coincident with recognizable somatic phases and (2) that the life-history is synonymous with the sexual cycle. In addition, nuclear phases are given over-riding importance over somatic phases. But are these views adequate and do the observed facts fit the theory? Take for example, the recent work of Kornmann (1954) on *Giffordia fuscata,* which shows that both the delophycean and adelophycean growths may arise not only from spores from both uni- and plurilocular sporangia but actually from the same unilocular sporangium. Kornmann concludes without the support of cytological evidence that both the delophycean and adelophycean growths in his cultures were diploid and that the species, to use his terminology, is heteromorphic but has homoplastic generations.

The view upheld by Kornmann and others in the interpretation of the adelophycean phases of the Phaeophyta is due to the overriding importance given to the nuclear phase as the factor determining the type of somatic phase which develops. As a corollary, all adelophycean phases are considered potential gametophytes. Fritsch considered the two phases had their origin in a heterotrichous ancestor. Yet another thesis, and all are hypotheses, is that the delophycean and adelophycean phases are not strictly associated with the events of the sexual cycle, karyogamy and meiosis, but depend rather on external conditions. The conditions under which spores are formed will influence their metabolic resources, i.e. the reserve food materials in the spore, and it seems reasonable to suppose that this in turn will influence the type of thallus resulting. The conditions under which the spores germinate will also influence their growth and development. It is to be noted that these adelophycean phases are known much better under conditions of culture than in the sea and we are all aware that we are only just beginning to learn how to culture algae and that under these somewhat unfavourable conditions adelophycean phases flourish. It is indeed a fact that some of these adelophycean phases are extremely hardy as well as being characterized by a comparatively simple degree of organization, and it is possible that they may play a comparable role in marine habitats to that played by hypnospores in freshwater habitats. Here then is a field of study where critical work freed from any preconceived ideas and theories might well be exceedingly rewarding.

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So much for the examples to show the need for critical work and fresh concepts. In what I have been saying I have been thinking mainly of the extension of our knowledge of the algae but I need hardly remind you this depends in the first instance on the supply of fresh workers and their training. It is therefore perhaps not out of place to remind you that the recruitment to the ranks of phycologists is not high and that the Society might well think of ways of increasing it. I realize that one contributory factor is the lack of active phycologists on the teaching staff of University departments of Botany and the remedy for this situation is not in our hands. It might be worth considering however, whether anything could be done to bring those who are responsible for the teaching of the algae or heads of department into closer contact with the activities of the Society so that post-graduate students can be put in touch with more experienced workers and the Society. I make these suggestions in order to start you thinking and considering possible courses of action.

Judging from the attendance at the meetings which have been organized so far, they have met with general approval but possibly we should also experiment before long and see whether there is a need for meetings of small groups interested in special topics, problems of taxonomy, cytology, culture and so on, meetings which would be much less formal and consist mainly of discussion, such meetings to be possibly in addition to, but not necessarily in place of, the general meetings. We could also experiment with our field meetings in such a way that we could add some positive information to our knowledge of the flora, by various members present being responsible for certain genera or families found and a comprehensive list being published in the Bulletin afterwards. As regards the marine flora, we need to explore as great a variety of habitats as possible and widely separated areas of the coast, either singly, in small groups or as a complete field meeting. I am sure Dr. Parke would welcome greater use of the cards published for the use of individual members regarding records of the occurrence of all species.

In the end, the success of the Society depends entirely on the contribution of its members, for the Society is in fact nothing more than the members. Members elect Council and while Council initiates policy, the carying out of this policy depends on the co-operation of the members. So there should be close and continuing contact between Council and the other members and it is essential that this be maintained. From the experience I have had on the Council I know that the running of a Society, such as this, with a very scattered membership, means a lot of work for the Officers of the Society, particularly the Secretary. So I would appeal to members to involve them in as little unnecessary correspondence as possible. Finally I would like to thank members for their support of the Council during my period of office and to say I am looking forward to co-operating in the Society in future as an ordinary member and seeing it from another point of view. May the Society justify its existence and flourish.

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JOINT MEETING OF THE BRITISH ECOLOGICAL AND THE BRITISH PHYCOLOGICAL SOCIETIES.

JULY 19th - 24th 1954.

A joint summer meeting of the Ecological and Phycological Societies, held at the University College of Wales Aberstwyth from July 19th - 24th was attended by sixty people, including twenty six members of the Phycological Society. The meeting was most enjoyable and all members were very comfortably accommodated in Ceredigion Hall on the sea front.

During the four days of the meeting there was an opportunity to see a great deal of the Welsh countryside. On Tuesday 20th, there were two excursions, one for zoologists to the Dovey Estuary, to examine the sand and mud-flats for molluscs and lamellibranches, the other for botanists who set off by coach to the salt-marshes and sand-dunes of Mochras near Harlech. After a picnic lunch, the extensive sand-dunes and slacks were explored under the leadership of Mr Chater, and many rare plants were found, including a large patch of fertile *Ophioglossum vulgatum, Selaginella selagionoides, Epipactis plastris* and *Polygonatum odoratum.*

On the salt-marsh *Bostrychia scorpioides* was seen in tangled masses round the roots of *Juncus sp.* and forming raised patches beneath the turf. *Fucus vesiculosus* ecad *muscoides* was growing in the mud as well as *Fucus vesiculosus* ecad *caespitosus* and *Fucus ceranoides* ecad *proliferatus.*

In the evening members were entertained in the Department of Botany where various interesting exhibits were on view including herbarium specimens of seaweeds and pteridophytes, mutants of *Spartina townsendii*, predacious fungi and an apparatus for photographing vegetation under water.

On Wednesday 21st, before the main excursion to St. Davids started, Dr J. R. Lewis gave a talk in the Zoology Department when he described some of the basic features of the zonation of sea-shores, mainly as elucidated by the work of Professor and Mrs Stephenson, and then discussed some of the problems particularly associated with the zonation on British coasts. An interesting discussion was cut short by the imminent departure of the 'bus to St. Davids. Brighter weather allowed us to enjoy good views of the scenery along the Cardiganshire coast, and we arrived at St. Davids at about 2 o'clock having had lunch in the bus *en route*. The party was then shown round St. Davids Cathedral by Canon Williams who gave us an interesting account of its architectural and historic features. An expedition to White Sands Bay proved very fruitful and seaweeds and shore fauna were collected. The inter-tidal zonation was well marked and two main features of phycological interest were the bay with large boulders emerging from the sand, with *Gracilaria verrucosa* dominant and the rocky headland which forms a rich ecological habitat. On the headland the rocks lie at an angle so that there are deep pools in the ledges between the strata. In these, lined by corallines, numbers of other algae find a sheltered home. Species gathered included *Bifurcaria rotunda, Gastroclonium ovatum, Cylindrocarpus berkeleyi* and *Griffithsia flosculosa*. Further out where oxygenation is very high, the Laminarias flourish and *Alaria esculenta, Himanthalia elongata, Desmarestia ligulata* and *Nemalion multifidum* were found.

There was an alternative excursion to the shore near Aberystwyth in the afternoon for those who did not wish to take the long one to St. Davids.

On Thursday July 22nd, a large party set off to climb Cader Idris, while a small one left in cars for the Llyfnant Valley to study the bryophytes under the leadership of Professor Richards. The walk up this very beautiful well—wooded valley was very enjoyable, and many rare liverworts and mosses were found on the wet slabs of rock at the side of the track. After going to the head of the valley to see the waterfall, and finding *Wahlenbergia hederacea* in flower, the party had tea in the garden of a cottage and walked down the valley to the parked cars.

The Cader party went by 'bus to Llyn Gwernan where they met Mr E. Price Evans, and then set off up the north side of Cader Idris. Half-way up Mr Price Evans gave a brief and lucid account of the geology of the district and described the main sites for the different types of flora in relation to the geology; the excursion was made much more profitable and enjoyable by his presence. A pause for lunch was made near Llyn Gafr and then in spite of dire warnings several of the party set out under the leadership of Mr Chater to climb over the summit of the mountain. The majority, however, spent the afternoon exploring the basic volcanic outcrops above Llyn Gafr with their rich flora including *Meconopsis cambrica, Saxifraga hypnoides, S. oppositifolia, Thalictrum minus* subsp. *montanum* and various calcicolous mosses and lichens. The fine Cwm and moraine of Llyn-y-Gader was also explored and many also went off to the north east over the Nardetum and Callunetum towards Mynydd-y-Gader where a search for *Genista pilosa* was finally rewarded. Eventually all those who had stayed on the north side returned to the 'bus and drove to the south side of the mountain where the party that had crossed over were safely collected for a welcome tea at Tal-y-Llyn.

The evening was spent in the Zoology Department, where Professor Stephenson first of all showed us a collection of colour transparencies taken in Bermuda. The party then took coffee amongst a large display of exhibits showing the work in progress in the Department. These exhibits included many beautiful paintings and photographs of sea shores and their fauna and flora by Professor and Mrs Stephenson; demonstrations on limpet ecology by Dr Lewis; the distribution of shore species by Dr Watkin; Welsh stream fauna by Dr Erichsen Jones; specimens, and beautiful drawings of Helminth parasites by Dr Rees; and some experimental work on colour change in the minnow and the reaction of small fish to toxic substances.

The 23rd dawned wet but about two thirds of the meeting went by 'bus to the western edge of Tregaron Bog. Here under the leadership of Mr Chater the small lagg was first examined, where beneath the *Salix* carr several of the interesting species described by Godwin and Conway were found, including *Comarum palustre, Menyanthes trifoliata, Scutellaria minor* and *Lotus uliginosus*.

The party then struck off across the main part of the bog while a few less stalwart members returned to the 'bus. Of special interest was the regeneration complex where all stages from hummocks dominated by *Calluna, Erica tetralix, Eriophorum vaginatum, Cladonia sylvatica* etc. and hollows with bare peat under shallow water could be seen. Prominent in the further development of the latter were *Zygogonium ericetorum, Sphagnum cuspidatum, S. papillosum, Drosera intermedia* and *Eriophorum angustifolium*. After arriving at the other side of the bog and negotiating a bridge which was in an advanced state of decomposition the party went to Devil's Bridge where an excellent tea in some measure dispelled the dampness.

The other party spent the afternoon visiting the Welsh Plant Breeding Station, and in spite of the rain enjoyed being shown interesting experiments in grassland improvement and the trial of new strains of grasses, which had been arranged by the Director, Professor E.T. Jones.

In the evening Professor Newton and Professor Stephenson held a reception in the College Hall, where the students Madrigal Group delighted the party with their singing in both Welsh and English. After coffee, Professor Newton showed the colour film taken during her visit to Australia, and we were transported to the seaweed covered rock-platforms and the wide lagoon-like estuaries of Australia and to the Great Barrier Reef.

This was a pleasant close to a very happy meeting, and all those who attended were full of praise for the excellent organization. The success of the meeting was due to the careful planning and work of Professor Newton, on whose invitation the Phycological Society met in Aberystwyth, and to other members of the staff of the College who so generously gave their time. On behalf of the members of the Society who attended the meeting I should like to take this opportunity of thanking them for all the work and trouble they took to make the meeting such a success. I hope that at some future date the Phycologists may again hold a meeting with the Ecological Society.

Helen Blackler.

VIIIth. INTERNATIONAL BOTANICAL CONGRESS
PARIS. JULY 1954.
PHYCOLOGICAL SECTION.

On Friday July 2nd 1954, the eighth meeting of the International Botanical Congress opened in Paris. Over 2,000 botanists from 87 different countries arranged themselves in 27 sections to discuss various aspects of the subject. For the first time, one section was devoted to Phycology (Number 17).

The Congress was of special interest because it coincided with the Centenary Celebrations of the Botanical Society of France. The opening ceremony took place in the Grand Amphitheatre of the Sorbonne, where the Symphony Orchestra of the Republican Guard interspersed the proceedings with music by Mozart, Handel and Bach. Among the addresses was one by the President of the Congress, Professor Roger Heim, and another by Professor Thimann of Harvard University U.S.A. Professor Thimann gave a masterly outline of the importance of Botany in human affairs, showing how close the subject was to the practical affairs of man and how deep its roots were in the most ancient practices of mankind. He spoke of the importance of the early study of Botany when it was linked so closely with medicine and the preparation of drugs. Then he outlined briefly the way medical men had turned for a while from regarding plants as of supreme importance and now, with the development of antibiotics, had returned to forge again a very close link with botany.

He drew attention to the wide influence of the research that has given rise to an increased yield in all kinds of crops, particularly the staple food crops, and then considered the immense influence on world economics and man's way of life, by the development of the tobacco and rubber trades. Professor Thimann continued to explain how, by using the stored energy in Coal and Oil, man was in effect using his capital inheritance. He stressed the danger of so-doing and urged that more timber should be grown, more trees planted, wherever possible,

> 'A noble forest in a wise man's hand
> Delights the eye and helps conserve the land.'

His address was most stimulating and was the right note on which to begin a fortnight's serious work on our subject.

Professor W.R. Taylor of the U.S.A. was President of the Phycological Section and there were several Vice-Presidents including Mrs Drew Baker and myself. The Secretary for Marine Algology was Professor Feldmann, the Professor of Botany at the Sorbonne. Both he and his wife put an immense amount into the general organization of the section as well as contributing important papers. Dr Bourrelly was responsible for the arrangement of the fresh-water papers and he too earned our warmest thanks and appreciation.

The Section began by devoting two sessions to the Chlorophyceae, a subject which made us immediately aware of the loss Phycology had sustained by the death of Professor Fritsch. His paper was read by the President and among the other speakers on that day were Professors Chapman (New Zealand), J. Feldmann (Paris) and Papenfuss (Berkeley).

The next session on the morphology and classification of the Rhodophyceae, Cyanophyceae, Phaeophyceae and Chrysophyceae included papers on epiphytism, endophytism and parasitism, the last named including a most interesting paper by Professor and Mrs Feldmann on the origin of parasitic Florideae.

On July 5th, a session on 'Life cycles and alternation of generations in the Algae' was opened by Mrs Baker, other contributors being Professors Schussnig (Jena) and Dangeard (Bordeaux). Miss Naylor, recently returned from Dunedin (New Zealand) also gave a paper on *Adenocystis utricularis.*

Skeletal structure and classification of the Coccolithophoraceae and the Diatoms occupied the morning of July 6th and the next day was devoted to a study of the ecology and geographical distribution of freshwater and aerial algae, Mr Ross (London) being one of the speakers. Subsequent sessions dealt with the Biochemistry and Physiology of the algae. Dr Woodward (Inveresk) opened with a general talk, and subsequent speakers included Dr Fogg, Miss Collyer and Mr I. Smith (London), Professor Dillon (Galway), Dr Vischer (Bâle) and Miss Nicolai (Leeds), the last speaker dealing especially with characteristic differences in wall composition in the Cladophoraceae.

The eleventh meeting was to have been opened by Professor Fritsch with a discourse on evolutionary trends among the algae in relation to the origin of vascular plants. Fortunately the article was in print so that we had the benefit of hearing it read by the President, Professor W. R. Taylor.

The next session on the cytology of the algae opened with a brilliant discourse by Professor Manton (Leeds) on 'The morphology of cilia as a guide to phylogeny.' This was one of the most important papers of our section of the Congress and was attended by a large audience who listened enthralled to the revelations of the electron microscope and the interpretation of its findings. Other speakers included Dr Parke (Plymouth) on the marine Chrysophyceae, Dr Levring (Gothenburg), Dr Godward (London) on the cytotaxonomy of *Spirogyra* and Dr G. C. King (London) on the cytology of the Desmids.

Monday July 12th was a busy day when the theme was the ecology and geographical distribution of the marine algae. The papers were world wide in their range and a number of members of the British Phycological Society contributed important and interesting material. Dr Blackler (St. Andrews) spoke on the phenology of the reproductive organs of some of the red algae and Mrs Conway (Glasgow), Mr Powell (Millport) and Mrs Burrows (Liverpool) all gave papers on different ecological and taxonomic problems related particularly to the Fuci. Mr F. T. Walker (Inveresk) gave a paper on Scottish Laminariaceae and Dr Lodge (Liverpool) on the sublittoral communities of the Isle of Man.

The closing meeting was devoted to the ecology of the marine Phytoplankton and included a paper by Kolbe (Stockholm) on the diatoms collected in the Swedish deep-sea expedition 1947-48.

During the meeting there were a number of receptions and excursions and the Botanical Society of France, under the Presidency of M. Roger de Vilmorin, formally received addresses and good wishes from Botanical Societies all over the world. On Monday July 12th Professor Heim gave a delightful reception in the Louvre where the Venus and the Victory were flood-lit with changing lights and refreshments were served under green palms in one of the main galleries. By that time our minds had acquired much food for thought and our bodies were sufficiently tired to make it a delight to sit and watch the kaleidoscope of colour, as people moved around and talked to friends from overseas; one of the most rewarding aspects of an International Congress.

Montreal has invited the Congress to meet there in 1959 so we separated for our various homeward journeys with new 'castles' already beginning to take shape in our minds.

Publications relative to the Congress may still be obtained from 'Constant Editeur, 5 Place de la Sorbonne, Paris 5e.'

'Rapports et Communications' 8,000 francs (9 vols.) Section 17 (Phycologie) alone, 900 francs.
'L'Histoire de la Botanique en France' 2,000 francs.

Lily Newton.

PRE - CONGRESS PHYCOLOGICAL EXCURSION TO THE CÔTE DES ALBERES BANYULS-SUR-MER. JUNE 22nd - 29th 1954.

A small party of the British Phycological Society attended the algal excursion held at Banyuls before the VIIIth International Congress in Paris. (Mrs Drew Baker, Dr Elsie Burrows, Dr Máirín de Valéra, Miss Hilda Parkes and Dr Helen Blackler).

At the Gare de Austerlitz, Paris, on the evening of June 26th we met Professor Feldmann the leader of the excursion, and phycologists from America, Holland, South Africa and other countries, and joined the Barcelona express. Throughout the night the train sped noisily southwards through the flat green cultivated countryside of Northern France; but by morning the scene had changed, and we passed through a landscape of high mountains, snow-capped and towering up into the cloudless blue sky. It was a scene with a very arid almost semi-desert appearance, grey stone terraces of the vineyards climbing up the hills, and the soft silvery grey of olive groves. We passed towns and villages with white, cream or pink houses with bright green, red or brown shuttered windows and flat roofs, surrounded by orchards with trees laden with apricots, scarlet flowered pomegranate hedges and tree-lined roads. There were umbrella pines dotted about on the hillsides and dark cypresses in the gardens; it was a countryside like a Cezanne painting. Past vineyards with men spraying the low growing vines, or weeding them in the cool of the morning, past rice fields and the great lagoons or étangs of the Camargue with their sandbanks, and reed-fringed salt marshes. Then came the dazzling blue of the Mediterranean. At length we reached Port Vendres and went by 'bus to Banyuls, with its wide bay at the foot of the vine-clad Pyrennees. There some of us lived in the large imposing Laboratoire de Biologie Marine de la Faculté des Sciences de Paris - Laboratoire Arago; and others in the Grand Hotel just across the road, where we all had our meals together: long leisurely meals of strange French food, where this miniature United Nations of Science conversed in English, French or German. For by now the party numbered about 25, consisting of British, Irish, French, Americans, Dutch, Danish, Swedish, German and Finnish members.

The Biological Station is a large three storied building which stands on a rocky promontory running out into the Bay and connected to the small rocky Île de Grosse by a causeway.

Excursions were made each day to interesting collecting grounds. On the first afternoon we collected on the Île de Grosse, this being our first introduction to the Mediterranean algal flora. Here the belt of Fucaceae so characteristic of the British Isles is missing and replaced by the red alga *Rissoella verrucosa* which looks brown and rather like small *Rhodymenia palmata* and forms a definite zone in the littoral region, below this occurs a belt of *Nemoderma tingitanum* forming a slippery brown felt on the rocks. The Fucaceae are represented only by Cystoseiras in the infra-littoral zone and in deep pools, *Cystoseira mediterranea* being the commonest species, with *Cystoseira fimbriata* in sheltered pools.

Colpomenia sinuosa is a common alga on this shore, growing in pools and on the rocks, looking exactly like *Leathesia difformis*. *Padina pavonia* also grows in many of the pools usually with *Halopteris filicina* and *Hypnea muscoides*.

In front of the Laboratory in the shelter of the causeway to the Île de Grosse much *Codium fragile* could be seen in the water. It is of interest that this alga has only recently colonized the Mediterranean.

On June 23rd there was an excursion to Cap du Troc to see the large cave. Most of the party went by boat, while a small group walked over the cliffs and had a good opportunity of seeing the flora of the maquis characterized chiefly by small low growing xeromorphic evergreen and often spiny shrubs with greyish green foliage; rosemary, *Rosmarium officinalis*, of our gardens flourished like a weed, and *Lavendula stachas*, a small flowered pink *Dianthus pyrenniacus*, *Echium vulgare* and species of *Cytisus* and *Ulex* and *Cistus* were also found. After a scramble round the foot of the cliffs examining the rocks and pools where *Colpomenia sinuosa* and *Padina pavonia* flourished, while *Stypocaulon scoparia* was very common as black balls in the pools and *Nemalion elminthoides* on the rocks, the cave was reached. The sides of the cave were covered with a growth of small red algae just above and below the water-line, *Peyssonnelia polymorpha*, *Petroglossum nicaeense*, *Griffithsia flosculosa* and *Bonnemaisonia asparagoides* and many other species which normally grow in deep water. Below the water-line was a growth of calcareous algae notable among them being *Tenarea tortuosa* which looks like a small brain coral, and *Liagora mediterranea* and *Amphiroa rigida*. Afterwards there was a pleasant sail back to the Laboratory where the afternoon was spent examining the catch.

On Thursday June 24th, a long whole day excursion was made by coach into Spain, climbing the Pyrennees by a long road consisting of one hairpin bend after another up to the top of one hill then down to a small fishing town, Cerbère, then up and down to Port Bou, the frontier town. After climbing up and down several times we eventually remained at sea level and stopped at Glifeu where there is a small bay and rocky shore. After careful searching in the pools, to our great delight we found *Acetabularia mediterranea* growing, a beautiful small calcareous alga which is much more like a toadstool than an alga. We also saw *Asperococcus bullosus* and *Liebmannia lebeillei* covered and coloured blue with the blue diatom *Navicula ostrearia* which is often taken in by oysters making them appear blue, *Liagora mediterranea* and *Galaxaura oblongata*, *Amphiroa rigida* and many other calcareous algae and *Colpomenia sinuosa*.

The drive continued past vineyards and olive groves and dark umbrella pines and woods of cork oak *(Quercus suber)* where we saw that some of the latter trees had recently been stripped of their cork. Here *Opuntia* prickly pear was growing at the roadsides and in flower and fruit.

At Cadaques a lovely little Spanish town of very white houses and buildings fronting the intensely blue Mediterranean we found *Posidonia oceanica* growing in the harbour, its fronds covered with many epiphytes, *Caulerpa prolifera*, a great bed of *Colpomenia sinuosa* and very large plants of *Codium fragile*.

On Friday June 25th the morning was spent dredging off Cap Bear just across the Bay from the Biological Laboratory and much *Halimeda tuna* var *platydisca* was brought up also *Valonia macrophylla*, *Codium bursa* in large balls, *Udotea petiolata*, *Dictyota dichotoma* and *D. linearis*, *Dictyopteris membranacea* and *Posidonia oceanica*.

On Saturday June 26th, the étang of Salses was visited, travelling by coach through many small villages and towns and passing through the limestone country of low hills where Noel Casteret, author of "Ten Years Under the Earth" explored the underground rivers and caverns of this area.

The étang of Salses is a large area of shallow water of very low salinity communicating with the sea at various places. The sandy floor of the étang is covered with large beds of *Zostera nana*, *Ruppia maritima* and *Chara aspera* f. *marina* and after a very careful search a little *Lamprothamnium papulosum* f. *salsensis* was found. *Acetabularia mediterranea* occurred fixed to cockle shells. There were many floating forms of Rhodophyta found among the *Zostera* such as *Lophosiphonia subadunca*, *Ceramium tenuissimum* and *Polysiphonia opaca*. A number of springs supply the étang with freshwater, the most important of which is the Resurgence de Font Estramer known since the time of the Romans. It is a deep pool at the foot of the limestone cliffs fed by underground streams, the water being at a temperature of 17°C. throughout the year. Great mats of *Vaucheria* which is always sterile and much *Enteromorpha* were growing in the stream leading from the pool.

In the vicinity some of us saw cicadas for the first time, in a tamarisk hedge where the branches were covered with these small fat beetle-like insects, making their monotonous noise not unlike the tuning up of a miniature jet plane. On the return from Salses we visited Bagès, an old fortified town on a hill looking across large étangs to Narbonne in the distance, once the capital of this former Roman province, while below we could see where the Romans berthed their galleys. To-day the fishermen's boats lie there and the Roman nettle still flourishes in Bagès.

On Sunday afternoon, June 27th, there was a display of folk dancing given in the court-yard of the school, the dancers being dressed in the various national costumes of the different Departments of the country. A very pleasant afternoon was spent watching the dancing, of which some of the steps and dances are similar to those of Scottish country dances.

On Monday, June 26th, Collioure a small fishing port not far from Port Vendres was visited. Here there is a very fine Castle built by the Knight Templars in the twelfth century on a cliff by the Harbour and across the harbour the old church of about the same age partly Norman and partly Gothic.

Unfortunately it was too rough to collect on the rocky plateau below the fort where the rocks are very exposed to wave-action and it was not fit to dredge. So after exploring Collioure we went on to Elne the pre-Roman Capital of the area. The Cathedral, which stands on a hill, dominating the Roussillon plain dates back to the eleventh and twelfth centuries. It has a very beautiful cloister with carved marble pillars and capitals and is almost the only one in Roussillon remaining where it was built.

Tuesday, 27th, was again too rough to dredge off Cap l'Abeille so the day was spent in finishing off the examination of material and in packing up; some of the party visited Île de Grosse again.

All too soon a very happy week came to an end and we boarded the night train for Paris and the Conference.

Our thanks for the delightful time we spent in Banyuls are due to Professor Feldmann for his kindness and expert organization, and to his assistants M. and Mme Magne; and also to Mme Lemoine for her unfailing helpfulness and information on local history and customs - as well as on the Corallinaceae.

Helen Blackler.

POST - CONGRESS PHYCOLOGICAL EXCURSION TO BRITTANY. ROSCOFF. JULY 15th - 20th 1954.

The main part of the Congress ended on Tuesday July 13th, and, after seeing the 14th July celebrations in Paris, members attending the phycological excursion left Paris to travel overnight to Roscoff. On arrival on the Thursday at 7.0 a.m. we found that we were most conveniently housed at the same hotel and that the Biological Station was on our doorstep. The extremely friendly atmosphere created at once by Professor Feldmann soon drew the cosmopolitan group of some 50 members together, and made a happy start to this very pleasant meeting.

On the first morning we set out with canvas buckets provided by the Station to collect near the laboratory on the Île Verte and in the channel separating it from the mainland. The richness of the flora was most striking, the more conspicuous plants in the channel being *Himanthalia elongata*, several species of *Cystoseira*, and *Bifurcaria rotunda*, whilst round the Île Verte varied habitats afforded many species. The fact that some of the plants, especially the reds, were bleached added to the difficulties of some members more accustomed to northern regions. In the laboratory in the afternoon we made a preliminary survey with the help of Professor Feldmann and his fellow organizers and the *Inventaire de la Flore Marine de Roscoff*, a gift from Professor Feldmann. We also found ourselves much indebted to the Rév. Père Pelletier who put his expert knowledge of the algae and other plants of the district so readily at our disposal throughout the excursion. In the evening Professor Drach, in the absence of the Director, led a conducted tour round the Station; we were much impressed by its size, its equipment for biological research and the residential quarters for students. We appreciated the customary French hospitality at the end of the tour.

On Friday the party was taken by 'bus round selected collecting grounds to the west of Roscoff. The high-light of this day was *Scinaia turgida*, with its bright red, forked, cylindrical thallus; though growing deep in the channel, a few specimens were washed up in good condition. A stop at a muddy creek afforded *Bostrychia scorpioides* and *Fucus balticus*. Besides the main objective of collecting algae, we were glad that stops were planned to see the 15th century churches at N-D du Folgoët, near Lesneven, and at St-Pòl-de-Leon. A visit to an alginate factory was most interesting and the careful sorting of *Laminaria digitata* from *L. hyperborea* drew attention to the superiority of the former species for this industry. As we passed through cultivated areas, stops were requested to photograph the fields of Jerusalem artichokes, one of the main crops of the district.

On the Saturday the party again toured by 'bus to some of the inlets to the east of Roscoff. Near Beg-an-Fry an excellent collecting ground afforded *Cutleria* and *Zanardinia* amongst many other species. The whole tour enabled us to see wonderful Breton scenery and again a local touch was provided by a visit to the ruined castle of Tonquédoc and a taste of the celebrated pancakes.

On Sunday we started early, again by 'bus, for a tour of the Finisterre district. At Morgat many species were collected along a rocky promontory; *Padina* was in good condition. At Pointe de Pen-Hir we had a magnificent view of the Finisterre coast and the small islands of "Tas de Pois" with the spray breaking over them; and the War Memorial was well worth seeing. A further stop enabled us to see some prehistoric erect stones or "Menhirs". Lunch on this day was at a special *langoustier* at the small fishing village of Camaret. On the way back a stop was made at an extensive area of peat marsh near Mont St-Michel de Brasparts; this is unique in this region and several interesting plants were collected, amongst them the very local *Sphagnum pylaiei*, (which occurs here, in Nova Scotia and Greenland) and *Erica ciliaris*, known in Britain as the Dorset heath! The church and Calvaire at Guimiliau were amongst the high-lights of this most interesting day.

On the Monday and Tuesday the trips were made by the Station boat to the island of Beclem and to the Pointe de Primel, across the Baie de Morlaix. The weather excelled itself for these two excursions and the algae were in good condition and less affected by the bright light. Many plants were collected, but perhaps worthy of special mention were the quantities of *Petrospongium berkeleyi* and *Nemalion helminthoides*. *Halicystis* and *Derbesia* have been recorded for Pointe de Primel, but were not collected on this occasion.

In the evenings the Director kindly allowed the laboratory to remain open for our use after dinner. The total number of species collected must have been impressive, but we select the following to mention in addition to those to which reference has already been made:- *Taonia, Aglaozonia, Halopteris, Asparagopsis armata, Antithamnion sarniense, Acrosorium uncinatum, Jania rubens, Chondria tenuissima, Pterocladia pinnata, Gigartina acicularis* and *G. teedii*.

On the Monday evening a special dinner was arranged when we much enjoyed the excellent local langouste, local wines and Jerusalem artichokes. This happy occasion afforded an opportunity for the President of the Phycological Section (Professor W. Randolph Taylor), and others chosen to represent different nationalities, to express the very deep gratitude of the party to Professor Feldmann and M. and Mme Magne for the most excellent arrangements made for the excursion, to Professor Drach and his Staff at the Biological Station, to Mlle. Abelard for general organization and special supervision of refreshments (we shall certainly remember the excellent picnic lunches, with drinks to suit all tastes), and to Mme Caram whose help as an interpreter added much to the success of the excursion. The menus for this dinner each had a beautifully pressed alga in winter condition and bore testimony to the trouble and long foresight given to the planning of this excursion by M. and Mme Magne. The dinner and speeches made a fitting end to this visit to Roscoff which will certainly live long in our memories.

E. Nicolai
L. I. Scott

THIRD ANNUAL GENERAL MEETING: LONDON, 4th JANUARY, 1955.

By kind permission of the College Council, a one-day meeting of the Phycological Society was held in the Department of Botany, Bedford College, Regent's Park, London, N.W.1., on Tuesday 4th January 1955. Professor L.J. Audus kindly acted as Local Secretary and host, and the meeting was attended by about 50 members. Some 15 members were accommodated in the College residence through the kindness of the Bursar, Miss G.E. Griffiths.

The programme consisted of a morning Symposium on the work of the Freshwater Biological Association, followed by several papers on the cytology and ecology of freshwater algae; Dr K.M. Drew Baker delivered the first Presidential Address to the Society, and the proceedings ended with the Third Annual General Meeting.

At 10.30 a.m. Professor L.J. Audus took the Chair for the morning session and welcomed the Society to Bedford College. The following papers were then contributed to the Symposium on the work of the F.B.A. (see authors' abstracts at end of this report):

1. J.W.G. Lund (F.B.A.): General observations on the Freshwater Biological Association.
2. B. Douglas (F.B.A.): Algae in streams.
3. D.F. Westlake (F.B.A.): The F.B.A. Pollution Unit. Polypeptides.
4. F.E. Round (Univ. of Birmingham): The algae of littoral sediments in lakes.

These papers were followed by discussion, and then the following paper was read:

5. G.C. King (Queen Mary College, London): Some features of desmid cytology.

Dr King illustrated his talk with some very fine cytological slides. Professor Audus thanked the speakers for their interesting papers, and at 12.45 p.m. members adjourned for lunch at the nearby College refectory.

At 2.15 p.m. the President, Dr K.M. Drew Baker, took the chair and delivered the first Presidential Address to the Society, entitled "Phycology and the British Phycological Society"; (this paper is printed in full in the present 'Bulletin'). Dr J.W.G. Lund then proposed a vote of thanks to Dr Baker both for a most stimulating address and for being such a good President throughout the first few difficult years of the Society's existence; the proposal was carried with warm acclamation. The following paper was then read and discussed:

6. C.H. Selby (Queen Mary College, London): Aspects of cytology and ecology in the genus *Coleochaete*.

In conclusion the Chairman thanked Professor Audus for affording the Society the facilities and hospitality of his Department, and for taking the chair during the morning session. Bedford College had proved to be a most agreeable meeting place and, with the Botany Department, refectory and residence all under one roof, quite ideal for the present snowy day. All present heartily endorsed these thanks, and then removed to the refectory for tea.

THE THIRD ANNUAL GENERAL MEETING started at 4.00 p.m., with the President (Dr Baker) in the Chair. There were 37 members present. The following summary of the proceedings of the meeting is taken from the official minutes.

1. **Letters from Members.** The Secretary reported that letters had been received from Dr E.M. Burrows, Mrs Iona Christianson (née Maclennan), Mr E.A. George, Dr T. Levring, Dr M.F.E. Nicolai and Mrs Sheila M. Nelson (née Lodge) - all regretting their inability to attend the present meeting and sending best wishes for its success. It was agreed to send greetings and best wishes to Dr Burrows who was unfortunately in hospital.

2. **The minutes of the Second Annual General Meeting**, held at University College, London, on 1st January 1954, were read by the Secretary and approved; the Chairman signed the minutes.

3. **Report of Hon. Secretary.** The Secretary gave a report of the meetings and other activities of the Society during the year 1954. (a) **Meetings:** the Society held two **general meetings** in 1954 - a one-day meeting at University College, London (the Second A.G.M.), on 1st January (see full report in Bulletin No.2); and the summer Field Meeting at Aberystwyth (a joint meeting with British Ecological Society), July 19th - 24th (see full report elsewhere in this Bulletin). (b) The 1954 **Council** met on 3 occasions, as follows: 1st Jan. (London), 3rd July (Paris), 4th Jan. 1955 (London). (c) Our two **subcommittees** have continued their work - one considering problems of Algal Nomenclature, and the other a revised Check-list and Flora of British marine algae (see subcommittee reports below). Mr Ross represented the Society at the meetings of the Nomenclature Section at the Botanical Congress in Paris. (d) It was regretted that Phycological Bulletin No.2 still had not appeared, although it was now ready for press. (A report from the Editor is summarized below). (e) **Membership** of the Society had increased from 93 to 102 during the year, and a welcome was extended to our latest members: Miss Yvonne Chamberlain (of the British Museum), Miss Margaret Fox (Ibadan, Nigeria), Mrs E.Greig-Smith, and Dr Margaret Naylor (who returned to Britain from New Zealand during the year). The Secretary urged the 20 members who still had not paid their 1954 subscription to do so as soon as possible, and hoped that most members would make use of the **Banker's Order Forms** that had recently been sent out. (f) The Society suffered a grievous loss in the death of Professor F.E. Fritsch, F.R.S., on May 23rd 1954. At the meeting of the Council of the Society held in Paris on July 3rd 1954 the following resolution was recorded:

   > "The Council and all members of the British Phycological Society note with deep regret the death of Professor F.E. Fritsch, F.R.S., one of the first Honorary Members of the Society. We wish to record our sympathy with Mrs Fritsch in the great personal loss she has sustained, and our appreciation of the immense contribution made by Professor Fritsch to botanical science and, in particular, to the study of algae."

   The President and Secretary have since sent an expression of sympathy to Mrs Fritsch on behalf of the Society. The Secretary's report was adopted.

4. **Report of Hon. Treasurer.** Dr M.T. Martin explained the Income and Expenditure Account and the Balance Sheet for the period December 1st 1953 to November 10th 1954 (see copy at end of this report), which shows a favourable balance at the bank of £104. The Balance Sheet was adopted and it was agreed to send our thanks to the two auditors (Dr G.C. Ainsworth and Professor W.T. Williams) for their continued services to the Society.

5. **Report of Hon. Editor of Phycological Bulletin.** The Secretary read a letter from the Editor, Mrs Sheila M. Nelson (née Lodge). Mrs Nelson regretted her inability to attend the present meeting and, in view of changes in her personal circumstances, regretted also that she would have to resign her honorary position as Editor of the Bulletin. Mrs Nelson was sorry that she had been unable to issue Bulletin No. 2 to date, but in a separate report gave a list of the contents of Bulletin No. 2 which was then ready to go to press. The report included a reminder that so far no reviews of current literature had been sent in by members, and stated the opinion that more papers of general interest, produced by members, should be included in future Bulletins, if the publication is to be more than a record of the proceedings of the Society. The Chairman then proposed, and it was agreed, that the report be accepted and that the thanks of the Society be sent to Mrs Nelson for her work with the Bulletin. It was further agreed to leave the appointment of a new Editor for consideration by Council, who would be discussing policy with regard to the Bulletin later in the day.

6. **Report of Secretary of Subcommittee for Marine Algal Check-list & Flora.** The Secretary then read the following report from Dr E.M. Burrows:

"The subcommittee for Marine Algal Check-list & Flora has held one meeting during the year (1954), at which the main discussion concerned the form of the proposed new Flora of British Marine Algae. A schedule was drawn up, on the basis of which information could be collected together in preparation for this, but no decision has yet been taken as to what should be the final form of the Flora.

In order to publicise the work of the subcommittee and to enlist help in the collection of the data necessary, a statement has been prepared by the Secretary for publication in the Society's Bulletin (see Bulletin No. 2, p. 23). In the statement are set out the schedules drawn up by the subcommittee, on the basis of which information will be collected for the Check-list and for the Biological Flora of British Marine Algae. The latter is to consist of a series of separate genus and species descriptions.

During the year the possibilities for the publication of such separate genus and species descriptions have been explored. An approach was made first to the Journal of Ecology but, as the position here seemed unsatisfactory, a second approach was made to the Journal of the Marine Biological Association. The Editor, Mr F.S. Russell, sent a very helpful letter saying that he would be pleased to publish the Biological Flora and that there would be no difficulty if the yearly output were only about 5 pages. He would be prepared to publish any amount of material if it were possible for the Phycological Society to make a grant to cover the cost of printing. In the absence of anything definite on which to base an estimate, he suggested that £2 per page would make it quite possible for the species descriptions always to be published in the J.M.B.A.

A report on this situation was sent to Council and was considered at the meeting in Paris on July 3rd 1954. Council agreed to the use of certain Phycological Society funds to support publication of species descriptions in the J.M.B.A. but the amount was left open until some idea can be obtained of the expected annual output of material. Very little can now be done on this matter until the first species description is ready for publication. It is hoped that this may be ready early in 1955.

(Signed) E.M. Burrows (Hon. Secretary)."

The report was adopted.

7. **Report of Secretary of Subcommittee for Algal Nomenclature, 1954-55.** Mr R. Ross read and commented upon the following report:

"The results of the questionnaire circulated around the Society early last year (1954) were:

Should the Latin diagnosis continue to be necessary?	Yes	18
	No	26
Should diagnoses in one or two modern languages be required?	One	7
	Two	31
Should one modern language be from a specified list?	Yes	39
	No	1

Languages to be on the list?	German	40	Russian	10
	French	40	Italian	3
	English	39	Chinese	1
	Latin	34	Japanese	1
	Spanish	10		

Should figures of new taxa be compulsory?	Yes	29
	No	7

The results of this questionnaire were forwarded to the Secretary of the Special Committee for Algae and considered by that Committee at its meeting during the International Botanical Congress in Paris.

At that Congress the following decisions of particular concern to phycologists were made:

(i) Names of new taxa of algae not accompanied by Latin diagnoses published up till now will be regarded as validly published. Latin diagnoses will be required in future - (after publication of a new (Paris) edition of the Code).

(ii) Names of new taxa of algae of specific or lower rank will in future require to be accompanied by a figure as well as a Latin diagnosis if they are to be regarded as validly published.

(iii) New names will in future only be validly published if their nomenclatural type is designated. At present the nomenclatural type of a species or lower taxon can be a specimen, a description, or a figure. The Special Committees for Algae and Fungi have been asked whether it is desirable to permit living cultures to be designated as types and also what measures should be taken to safeguard a consistent application of the type method if it is technically impossible to make permanently preserved specimens of some kinds of plants.

(iv) The various Special Committees were asked to consider whether the rules of priority and typification should apply to the names of families and orders. At present, they do not apply to taxa above the rank of order. The Special Committees were also asked whether it is possible to draw up a list of family and ordinal names which would command a reasonable measure of general acceptance and might perhaps serve as a starting-point for the nomenclature of families and orders.

The (written) views of members of the Society on the matters raised in paras. (iii) and (iv) above will be welcomed by the Subcommittee, who will communicate them to the Special Committee for Algae.""

The report was adopted.

8. **Election of Honorary Member of the Society.** The Chairman formally moved a proposal from Council that Dr Margery Knight, who had recently retired from Liverpool University, be elected an Honorary Life Member of the Society. Dr Baker paid tribute especially to Dr Knight's pioneer work on the Ectocarpales and to her training of students, and mentioned also the enthusiastic support that Dr Knight had always given to the Phycological Society. The proposal was cordially carried.

9. **The programme for the Field Meeting** to be held at The Ferry House, Ambleside, Sept. 8th - 15th 1955, was next discussed. Dr J. W. G. Lund outlined a proposed programme and this was heartily approved. It was agreed that members would want to collect and examine algae, use boats and equipment, etc., as much as possible, and that a few lectures would be most welcome. At least one excursion would be to a coastal area for collection of marine algae. Dr Conway inquired whether or not senior students would be welcome at Field Meetings and it was agreed that small numbers of senior students may attend if there is any accommodation available after all members have been housed; decisions would rest with Dr Lund in the present instance. Dr Lund remarked that if a large number of members attended the meeting, a few private cars might be useful to transport people to and from the more distant lodgings.

10. **Amendments to the Constitution & Rules.** The following three amendments to the Constitution were considered and unanimously approved; the first two were put forward by Council, and the third proposed by Dr M. W. Parke and seconded by Miss D. Ballantine:

    (i) **Add** the following sentence to the end of **Clause 10 (a)**: "**The immediate past-President shall continue to serve on Council (ex-officio) until succeeded by the next retiring President.**"

    (ii) **Revise Clause 9 to read** as follows: "The business of the Society shall be conducted by a **Council of 12 Members** consisting of the **5** Officers of the Society, namely, the President, two Vice-Presidents, the Honorary Secretary and the Honorary Treasurer, together with **the immediate past-President and** not more than 6 Ordinary Members of Council; five to constitute a quorum. All members of Council, **except the immediate past-President**, shall be elected by postal ballot, the result of the ballot being declared at the Annual General Meeting (see Clause 14)."

    (iii) **Add** the following sentence to the end of **Clause 18**:
    "**In case of an equality of votes at any meeting of the Society or of the Council, the Chairman may exercise a second or casting vote.**"

11. **Election of Auditors for 1955.** It was proposed by Dr Martin, seconded by Professor Newton, and agreed, that Dr G. C. Ainsworth and Professor W. T. Williams be invited to continue serving as Hon. Auditors to the Society.

12. **Election of Officers and Members of Council for 1955.** The following Officers were now elected to the 1955 Council: **President**: Professor Lily Newton; **Vice-Presidents**: Dr J. W. G. Lund, Dr Mary W. Parke.

Seven nominations had been received for four vacant offices of **Ordinary Member**. The result of the postal ballot for these offices was worked out during the course of the present meeting by Dr P. S. Dixon and Dr D. E. G. Irvine, and the Chairman now announced that Dr E. M. Burrows, Dr M. R. Droop and Mr E. A. George had been elected to serve for a two-year period, and Dr Betty

Moss elected for a period of one year (in place of Dr Parke, now elected Vice-President). (A full list of members of Council for 1955 is given below).

There being no further business, the Chairman declared the meeting closed.

H. T. Powell, Hon. Secretary.

THE BRITISH PHYCOLOGICAL SOCIETY
MEMBERS OF COUNCIL AND SUBCOMMITTEES FOR THE YEAR 1955.

President: Professor L. Newton.
Vice-Presidents: Dr J. W. G. Lund, Dr M. W. Parke.
Hon. Treasurer: Dr M. T. Martin, University Hall, Bangor, Caernarvonshire, North Wales.
Hon. Secretary: H. T. Powell, Marine Station, Millport, Isle of Cumbrae, Scotland.

The Council consists of the above five Officers, together with: **The immediate Past-President:** Dr K. M. Drew Baker, and the following six **Ordinary Members:**

To retire December 1955:	**To retire December 1956:**
Dr G. E. Fogg	Dr E. M. Burrows
Dr B. Moss	Dr M. R. Droop
R. Ross, Esq.	E. A. George, Esq.

Hon. Editor of 'British Phycological Bulletin': Dr E. Conway, Department of Botany, The University, Glasgow, W. 2.

Hon. Auditors: Dr G. C. Ainsworth, Professor W. T. Williams.

Committee for Marine Algal Check-list and Flora:
Dr M. W. Parke (Chairman), Dr E. M. Burrows (Secretary), Dr K. M. Drew Baker, Miss D. Ballantine, Dr H. Blackler, Dr R. W. Butcher, Dr P. S. Dixon, Dr M. R. Droop, Mr N. I. Hendey, Dr M. T. Martin, Dr M. Naylor, Mr H. T. Powell.

Committee for Algal Nomenclature:
Mr R. Ross (Secretary), Miss C. I. Dickinson, Mr E. A. George, Dr J. W. G. Lund, Dr M. W. Parke.

BRITISH PHYCOLOGICAL SOCIETY

Income and Expenditure Account: December 1, 1953 - November 10, 1954

Expenditure	£	s	d	£	s	d
Purchase of reprints	10	3	11			
Less stock remaining	5	18	4			
				4	5	7
Postage and stationery				9	6	1
Printing and duplicating				5	0	0
Subscription, Biological Council					5	0
				18	16	8
Surplus				84	2	3
				£102	18	11

Income	£	s	d	£	s	d
Subscriptions received 1954	52	0	0			
Add received in advance, 1953	7	0	0			
Add unpaid, 1954	38	0	0			
				97	0	0
Sale of record cards				1	7	6
Sale of reprints				4	5	7
Surplus from Jan. meeting					5	10
				£102	18	11

Balance Sheet at November 10, 1954

Capital and Liabilities	£	s	d	£	s	d
Capital at Dec. 1st, 1953	69	6	3			
Less sale of record cards	1	7	6			
				67	18	9
Add surplus				84	2	3
				£152	1	0

Assets	£	s	d
Balance at bank	104	4	6
Stock of reprints	5	18	4
Stock of record cards	3	18	2
Subscriptions in arrears	38	0	0
	£152	1	0

(Signed) M.T. Martin, Hon. Treasurer.

We certify that the above Balance Sheet and Income and Expenditure Account are in accordance with the books and vouchers of the British Phycological Society, which we have duly audited; and in our opinion they give a true and correct view of the transactions of the Society for the period December 1st, 1953, to November 10th, 1954, and its position at November 10th, 1954.

(Signed) W.T. Williams)
G.C. Ainsworth) Hon. Auditors.

AUTHORS' ABSTRACTS OF PAPERS READ AT BEDFORD COLLEGE, LONDON, 4th JANUARY 1955.

1. The Freshwater Biological Association: General Observations. **J.W.G. Lund.**

In 1927 Professor Fritsch was president of Section K at the British Association's annual meeting. Towards the close of his presidential address, he deplored the lack of any British organization for the study of freshwater biology and pointed to the important research emanating from such stations in Europe. He was not the first person to have such opinions, indeed that remarkable naturalist Mr Scourfield had already voiced them but the combined effect of the occasion and Professor Fritsch's eminence resulted in a special discussion about the formation of an association for this purpose at the next year's British Association meeting. In June 1929 the Freshwater Biological Association was founded at a meeting held in the rooms of the Linnean Society. Fritsch was made chairman of the Association's council, a position he held for almost a quarter of a century. The association was very fortunate in having from the beginning two other very able people who have played a great part in guiding its destiny. Professor Pearsall's wide interests, stimulating influence and unique knowledge of the Lake District have meant much to the Association while another very good friend has been Mr J.T. Saunders of Cambridge who is also a zoologist and a man of great administrative ability.

In 1931, the Development Commission promised a grant of £450. Meanwhile £250 was obtained from universities, waterworks, fishing bodies, etc. On the strength of this on September 23rd 1931 a station was opened in part of Wray Castle on the western shore of Windermere - a very happy choice of location. There were two resident naturalists, Mr Beauchamp, now director of the East African Fisheries Research Organization at Jinja and Mr, now Professor Ullyott. The single laboratory assistant was Mr Thompson who is now laboratory steward. Professor Pearsall acted as honorary director.

Before long Drs Allan, Macan, Mortimer and Rosenberg joined the staff and Dr Worthington was appointed director. However, even in 1945 there were only 6 scientists and 4 laboratory assistants on the permanent staff. Shortly afterwards Dr Worthington left and Mr H. Cary Gilson, the present director, succeeded him and the Association owes much to him for his work during the years immediately after the war when with greatly increased resources it expanded rapidly and in 1950, exactly 19 years after its start at Wray Castle, moved its headquarters down the lake to the Ferry House. Some idea of the Association's growth may be gained by the following statistics. In 1932 there were two scientists and one assistant and the annual income was £700; in 1944 there were six scientists, four assistants and an income of £4848 while in 1954 there were 20 scientists, 25 assistants and an income of over £40,000. In 1955 there will be one more scientist and at least two and possibly four more assistants. There are also a librarian, an accountant, secretarial staff of two, and a domestic staff of four, a total of 53 people.

The Freshwater Biological Association is an autonomous organization governed by its own council which is served by two main committees, the Scientific Advisory and the Finance. However, it is financed from government funds. Some money comes from the subscriptions of the 700 members, fishery and waterworks interests, the universities and other bodies, but the total from all these sources is relatively small. The Association is responsible to the Development Commission, with the Ministry of Agriculture and Fisheries holding, as it were, a watching brief. There is a Fisheries Advisory Committee under the chairmanship of Professor Sir James Gray and composed largely of scientists which advises the Development Commission and, every five years, pays a visit of inspection.

The staff are, within all reasonable limits, free to do what they like, though they must report twice a year to the Scientific Advisory Committee and hold a discussion with its members.

There are three sections to the Association and a fourth, a southern station on the Hampshire Avon as yet not in action owing to lack of money though a site has been bought. The main activity centres at Ferry House and comes under the category of pure research. A sub-station, the Pollution Research Unit is centred at Maple Cross Sewerage Works near Rickmansworth. The work there, though not aimed directly at any applied project is, however, something of a compromise between pure and applied research. Applied research should start next year in London when the so-called Thermal Unit is formed, This concerns the effect of warm or hot effluents upon fish. Since the health of fish is not unrelated to that of other organisms in rivers etc. it may well be that some observations of interest to phycologists will be made later on.

At first, however, experimental work will be done on fish kept in tanks improvised from the base of a partly built cooling tower at a power station.

In conclusion Dr Lund gave a summary of the various non-phycological researches being carried on at the Windermere Laboratory.

2. Algae in Streams.

Barbara Douglas.

The only detailed quantitative work on the ecology of attached algae in streams that has been done is that by Butcher, who used the method of suspending glass slides in the water - a method which has certain disadvantages. An investigation is in progress on the algae growing in a small Lake District stream, Belle Grange Beck, using methods which have been devised for estimating the growth on stones which can be removed from the beck, permanent rock, and mosses. I want to show here the results for one particular species of diatom, *Acnanthes minutissima* Kütz. (together with var. *cryptocephala* Grün. and *A. linearis* W. Smith) and, by relating this to one particular factor acting in the beck, namely the flow of the water, illustrate the sort of problems which are involved and the sort of interpretations which can be put on the results. I must emphasize that this work is still in progress and many of the conclusions that I have drawn are still only tentative, and may prove incorrect later on.

The fact that the water is flowing is the most important thing about a stream or river and the character by which it differs from any other aquatic habitat. It is obviously a factor of great ecological importance, both directly and indirectly. It may have such effects as an indirect chemical one, for an alga in a stream is immersed in a continually changing culture medium, and a far larger growth may be supported than would be so in a standing body of water of comparable chemical composition. The most important direct effect is that of flooding, for any attached alga must be able to remain attached however fast the flow. In an area like the Lake District, where run-off is very rapid, the flood conditions in a beck reflect the rainfall of the immediate past, and the Ferry House rainfall records are therefore taken to show the conditions of flow operating in Belle Grange Beck.

When the population of *Acnanthes minutissima* on the stones, at those collecting stations where a high population does sometimes occur, is considered in relation to rainfall, it is seen that continual heavy rain results in the maintenance of a low population, and that sudden heavy rain after a period of dry weather results in a sudden drop in population. For example, in the early spring of 1953 a much higher population was present than at the same time in 1954, and a much drier spell of weather occurred; very low numbers were maintained throughout the whole period of exceptionally heavy and continual rain at the end of 1954; a violent storm in June 1953 (during which 4½ inches of rain in about an hour were recorded in the Troutbeck valley to the N.E. of Windermere) resulted in a catastrophic drop in numbers. But this correlation of a low population on the stones with flood conditions may be due either to the actual washing-off of cells or the disturbance of the actual bed of the beck. Collections from permanent rock were not started until the spring of 1954, owing to difficulties in working-out the sampling method, but what results I have indicate that heavy flooding does not cause a decrease in population. Indeed, during the continual flooding from September to December of 1954 the population on the permanent rock increased greatly, particularly on those areas of rock which are normally above the water level. The effect of a sudden flood after a period of dry weather is not yet certain, but it does not appear to cause so great a decrease in algal numbers as on the stones.

Thus it appears that the disastrous effect of a flood on the population on the stones is due, not so much to the washing-off of cells as to the disturbance and overturning of the stones in the bed of the beck. At first sight, it might be expected that the washing-off of cells would be greater than it is. However, it is known in elementary aerodynamics that when any fluid is flowing over a surface there is a very thin layer, the boundary layer, immediately above the surface, across which there is a change in velocity, due to the viscosity of the fluid, from zero at the surface to the velocity of the fluid stream at the top of the layer. The conditions of flow, laminar or turbulent, in the boundary layer, are not necessarily the same as the conditions outside it. A very small algal cell, such as an *Acnanthes* or small *Gomphonema*, may well be immersed in the boundary layer, and unaffected by changes in the flow of water outside it. All this, however, is highly theoretical, and as yet quite unsupported by any evidence, although I hope in the future to go into in experimentally.

3. The Freshwater Biological Association Pollution Unit.

D.F. Westlake.

Pollution Research Unit. This is based on the River Colne, Hertfordshire, where the effluent from a large sewage works flows into it.

An investigation of the contribution made by plants, including algae, to the oxygen balance of the river has not progressed beyond an examination of the literature and methods.

The algae have been investigated by the glass-slide technique, with a view to explaining their distribution in terms of differing growth rates under differing conditions. Such work is needed to provide a theoretical basis for the use of indicator organisms in pollution studies. So far results have been expressed as algal units, which is an arbitrary measure and needs comparison with cell numbers, cell volume and percentage occurrence.

River stations one mile upstream, and 2.5 miles below the entry of the effluent show a similar algal flora, with a predominance of diatoms in the spring and autumn and colonial Chlorophyta in the later summer. *Ellipsoidion oocystoides* is also abundant at this time, especially just below the junction of the river and effluent.

In the effluent a *Stigeoclonium* species (probably *S. tenue*) is abundant, and there are generally few diatoms. A *Cladophora* species (probably *C. fracta*) is abundant as floating mats in the summer in the effluent and in the river below. Very few species are absolutely restricted to either the river or the effluent.

In both river and effluent maximum growth occurs in the spring and summer. The actual month of maximum growth, as measured, depends on the nature of the community because estimates as algal units are heavily weighted against colonial and filamentous forms. Similarly growth in the effluent appears less than in the river because the flora is filamentous; though the lesser transparency of the water may also play a part.

Polypeptides. Such compounds have now been shown to be excreted during normal growth by *Chlamydomonas moewusii, Navicula pelliculosa,* and *Tribonema aequale;* these records are in addition to the original observation of their excretion by *Anabaena cylindrica,* made by Dr Fogg (see Fogg, G.E. & Westlake, D.F., Proc. XIIth. Int. Limnol. Cong. (1953)).

Their presence in lakes, forming about 25% of the total soluble organic nitrogen, has been confirmed by work in the Lake District and on a London reservoir. The concentration was not correlated with trophic status, but was correlated with algal cell numbers in the sampled water.

Polypeptides form chelation complexes with ions, which can be demonstrated in many ways, including potentiometric titrations. *A. cylindrica* polypeptide showed chelation with copper, ferric ion, organic dye ions, phosphate and zinc. *C. moewusii* peptide showed no complex formation with zinc. Dr Fogg has shown that complex formation can increase the solubility of calcium phosphate and can reduce the toxicity of copper to *A. cylindrica*.

4. The Algae of Littoral Sediments in Lakes.

F.E. Round.

The littoral zone of lakes is by far the richest region of algal growth. The algae may be subdivided into three communities within this zone, epiphytic, epilithic and benthic. Some authors consider all these to be part of the benthos (or Aufwuchs or Periphyton) but in my opinion this is not desirable, since each is a relatively self-contained community with very characteristic life forms and genera. The term benthic applied to algal communities should be confined to those forms which live on the sediments.

Such a flora is widespread on almost all stable sediments provided they are not coarse grit or sand and are relatively undisturbed by current action.

The extent of this flora is determined largely by the shape of the lake basin, for in shallow basins or in lakes with many dissected bays the littoral may extend over most of the lake bottom. In the English Lake District the lakes, being glacial in origin, tend to be deep with relatively steep sides. Hence it is only in the shallower bays or on less steep shelving slopes that a good benthic sediment flora is developed.

Methods of sampling are all-important if a reasonable picture is to be obtained. For quantitative work, any method which involves the removal of the surface sediment (contaminated as little as possible by the lower sediment) may be used. Direct microscopic observation yields very little information unless the sediment is extremely rich. Since the forms living in the benthos are almost without exception actively phototactic it is better to leave the sediment in a Petri dish with most of the water removed and ideally with cover glasses on the surface. Leave 24 hours and then pick off the cover glasses and a rich flora is found adhering to the undersurface which, with certain precautions, can be used for quantitative estimates of the flora.

Results from this method show quite clearly the dominance in the benthic community of the group Bacillariophyta over all others. Next come the Cyanophyta and finally, making up a mere fraction of this flora, the Chlorophyta and a few species of the Flagellate groups. This composition of the community is almost certainly due to the prevailing chemical conditions of the sediments and waters, and the general morphometric nature of the basin, since other sediments studied since have a much greater preponderance of either Chlorophyta (Desmids) or Flagellate forms.

Of the algae occurring, it is mainly species from the motile classes that are common, e.g., the Bacillariophyta almost all belong to the section Pennales/Biraphidineae, e.g., *Navicula*, *Pinnularia*, *Nitzschia*, *Neidium*, *Caloneis*, *Surirella*. The Cyanophyta are either members of the

Chroococcales - *Merismopedia, Holopedia,* etc., or the Hormogoneales - *Oscillatoria, Lyngbya, Phormidium.* The Chlorophyta, apart from isolated Volvocales, are confined to the Chlorococcales - *Scenedesmus* and *Pediastrum,* or the Conjugales - Desmids - *Cosmarium, Closterium, Euastrum, Micrasterias,* etc., and the Flagellates belong to varied groups, Euglenophyta, Cryptophyta and Dinophyta being the more predominant groups represented.

There are at least three major variables affecting the quality and quantity of this flora: depth at which the sample is taken, chemistry of the sediment and of the lake waters, and the season at which samples are taken.

(i) **Depth.** Since the forms are all photosynthetic, the penetration of light will affect their distribution in the littoral zone. In the lakes studied with respect to this feature (Blelham Tarn and Windermere N. basin) the extinction of the flora occurred at approx. 6 m. Below this level the light is presumably too low to permit active growth. The first metre is also relatively unfavourable for growth. Some authorities suggest this is due to too great an intensity of light although it is probably due to more intense disturbance of these shallow sediments. Growth does not appear to gradually decrease over the depth 0-6 m. but rather there is a great intensity of growth around 2 m., a smaller peak often at 4 m., and then a very abrupt dying off after 6 m. This of course cannot be taken as a general figure since in lakes such as Wastwater and Ennerdale light penetration is greater and hence growth is probably extended to lower depths, and in other regions the penetration may be much less due to suspended matter in the water, etc.

(ii) **Chemistry.** Some attempt was made to analyse the sediments but only the major effects of certain chemical features can be considered.

The sediments consist of inorganic matter with an admixture of organic debris varying from 9% to 40%. In general this admixture has the effect of increasing the growth of most forms at its higher levels. This is very clear if certain elements of the flora are considered, e.g., the Euglenoids. The Ca content and pH., and PO_4 concentrations, in general, increase with increasing organic content and it may be that these nutrients are also affecting the distribution of the various components of the flora, since high values for any of these seem to be associated with high productivity. Total nutrient index (an index derived from an analysis of all the nutrients measured) shows the effect of nutrients on groups of species - e.g., *Frustulia* and *Eucocconeis* are confined to lakes with a low nutrient index (i.e. oligotrophic); others, e.g., *Neidium hitchcockii, Stauroneis smithii* and *Diploneis ovalis* are confined to the lakes of high nutrient index (as are most of the Cyanophyta and Flagellates); while others(*Caloneis silicula* and *Neidium iridis*) are common over the whole range.

(iii) **Seasonal variation.** As in almost all plant populations there is a seasonal development resulting in both a change in numbers of cells in the population and in composition of this population. In the more unproductive lakes the total production of cells is very low and the seasonal rhythm likewise damped down. The seasonal rhythm of the population - both Diatoms and Cyanophyta - in some of the more productive lakes shows a considerable increase during the spring, reduction in growth in early summer, a smaller autumn maximum, followed by a low period in November, possibly coinciding with the autumn overturn. The nutrient values for the waters here follow a distinct cycle as opposed to those of the unproductive lakes.

Total production in the littoral zone. Although the analysis of the data is still incomplete, it is possible from the depth distribution data to compile graphs of the total production of cells in the photosynthetic zone of the littoral. These graphs show that the total production, unlike that for any one particular station, follows closely the curve of total incident light and temperature for the year. This type of curve is due to the peaks of the spring growth occurring later in the season at lower depths.

5. Some Aspects of Desmid Cytology.

G.C. King.

Recent investigations into the cytology of the desmids have confirmed previous reports (cf. Lutman, 1910, 1912, and Kopetzky-Rechtperg, 1932) of both intergeneric and interspecific variation in the number and structure of the nucleoli, and have shown that, in *Netrium digitus*, intraspecific variation also occurs. From studies of the mitotic behaviour of the desmid nucleoli, it has been possible to demonstrate their structure and organization. In all, four main types of structure have been found; these are:-

(i) Solitary, simple, spherical nucleoli.
(ii) Two or more simple, spherical nucleoli, not intimately associated together, although contained within the same nucleus.
(iii) A large number of small, spherical nucleoli, intimately associated together to form one or more bead-like strings.
(iv) A complex sausage-shaped nucleolus which is sinously coiled around itself, to form a sub-spherical mass at the centre of the nucleus.

The nucleoli falling into the first of these groups are by far the most widespread in the Family Desmidiaceae (sensu West and West, 1904). Their organization appears to be similar to that described in *Zea mais* by McClintock, 1934, i.e. they are formed by, and around, a short region (the nucleolar-organizing region) of one of the chromosomes of the set, the so-called nucleolar-organizing chromosome. Nucleoli conforming to the second group have, so far, only been found in *Netrium digitus*, and may be the result of duplication and/or fragmentation of the N.O. chromosome(s). The third group appear to be fairly widespread in the genus *Micrasterias* and have resulted from a great increase in length of the N.O. region of the N.O. chromosome, along the length of which the nucleoli are formed in great numbers. The fourth group, which appear to be confined to some species of the genus *Closterium*, again appear to be the result of an increase in length of the N.O. chromosome but, in this case, the nucleolar material, instead of being organized into separate nucleoli, forms a continuous sheath over the N.O. region. This sheath bears some resemblance to the N.O. track, described in the nucleolus of *Spirogyra* by Dr Godward, 1953.

In a previous paper to this Society (1952) I reported the incidence of parallel disjunction of chromatids at anaphase in two species of desmids. Since then, this phenomenon has been observed in all species so far studied, with the sole exception of *Mesotaenium caldariorum*, and the long N.O. chromosomes of *Micrasterias thomasiana* and *M. rotata*. Such parallel disjunction is the result of the peculiar centromeric organization of the chromosomes, in which, regions having centromeric properties are interspaced with regions lacking in these properties. By the processes of either fragmentation or fusion of such chromosomes, variation in the chromosome number can occur without changes in the genetic content of the nuclei. Such changes have been found to occur in the genera *Luzula* and *Carex*, and from the counts so far made (which are given in the table below) also appear to occur in the desmids.

Table of Chromosome Numbers of Desmids.

Species	n =	Author
Closterium acerosum	60	van Wisselingh, 1912.
" "	c. 60	King, unpubl.
" ehrenbergii	60	van Wisselingh, 1912.
" moniliferum	c. 66	King, 1953.
Cosmarium botrytis	30	Karsten, 1918.
" " (Clone A)	18	King, 1953.
" " (Clone B)	26	King, 1953.
" " (Clone C) var?	c. 94	King, 1953.
" cucumis) same clone	44 & 52	King, 1953.
" subtumidum	24	King, 1953.
Cylindrocystis brebisonii	c. 20	Kaufmann, 1914.
" "	c. 80	King, unpubl.
Desmidium swartzii	c. 28	" "
Gonatozygon monotaenium	c. 34	" "
Hyalotheca dissiliens	c. 12	Acton, 1916.
" "	c. 112	King, 1953.
" " f.minor	15	Pothoff, 1927.
Micrasterias angulosa	60 -64	Waris, 1950.
" denticulata var. notata	35 -40	Saraswathi, 1946.
" rotata) same clone	c. 200	Waris, 1950.
" ")	c. 172	King, unpubl.
" thomasiana	c. 34-38	Waris, 1950.
Netrium digitus	32	Maguitt, 1925.
" "	c. 30	Kopetzky-Rechtperg, 1932.
" " (C clone)	c. 172 - 182 &	King, unpubl.
" " (M clone)	592	King, 1953.
Pleurotaenium trabecula	104	King, 1953.
Sphaerozosma vertebratum	c. 20	King, unpubl.
Spondylosium pulchellum	c. 18	" "
Staurastrum gracile	c. 14	" "

6. The Distribution of the Genus *Coleochaete* (Breb.) in the English Lake District.

C.H. Selby.

The distribution of four members of the genus *Coleochaete (C. nitellarum, C. pulvinata, C. scutata, C. soluta)* in the English Lake District shows a correlation with the geological formations and the mineral content of the waters in which the algae grow.

A representative sample of the macrophytic vegetation from fifty tarns, selected at random, was examined for the presence of *Coleochaete spp.* These tarns are in two categories:- (i) those occurring on volcanic rocks; (ii) those occurring on sedimentary deposits. All four species occur in tarns of the second group but only *C. scutata* occurs in tarns of the first group. Tarns above the thousand feet contour on the volcanic rocks are lacking in *Coleochaete spp.*

C. scutata shows the greatest range of toleration of mineral salt concentration, but all four species show the same optimum concentration of both anions and cations studied. The optimum concentrations are:-

Calcium, 5.5 p.p.m.; Magnesium, 1.0 p.p.m.; Potassium, 0.3 p.p.m.;
Sodium, 4.5 p.p.m.; Bicarbonate, 0.05 me/l; Chloride, 0.17 me/l;
Sulphate and Nitrate, 0.2 me/l.

Experiments on *C. scutata* with inorganic culture media show a maximum rate of mitosis at salt concentrations far higher than those encountered in nature.

REVIEWS.

Annual Report of the British Freshwater Biological Association - 1954.

In the **Freshwater Biological Association's** 23rd Annual Report for the year ended 31st March 1955 (obtainable from the Association, The Ferry House, Ambleside, Westmorland, for 3/-), the report of the Director on the scientific work of the staff includes some matters of interest to phycologists. From the results of analyses of rain water, it is clear that many high altitude tarns contain practically nothing other than rain-borne solutes. As this primary solution comes more into contact with soils and rocks, the hydrogen ions are first exchanged for calcium and magnesium, and further contact, particularly in areas of softer rock, brings additional quantities of these elements into solution as the bicarbonates. The solutes present in rain come in part from the sea, and in part from industrial pollution.

Some details are given of the cultural work on the plankton diatom *Asterionella* including the effect of mud extracts. An account of a survey of the standing crops of plankton algae in more than a hundred tarns shows that these tend to be larger as the total concentration of ions increases, which means in practice that there is a rough correlation between the size of crop and concentrations of calcium and bicarbonate ions in this area of largely non-calcareous water.

Work in progress on the algal flora of a small beck points to floods playing an extremely important part in regulating algal population on stones, but not necessarily on permanent rock faces, and it is possible that reduction in the flora in stony areas is due rather to their movement in the bed of the beck, than to a direct effect of the increased flow in washing algae off them. Another important factor probably is the grazing of Caddis larvae.

Routine investigations of the fungi parasitic on plankton algae have been continued.

The Pollution Research Unit have been studying algae in the effluent channel from a big sewage works and in the river above and below the entry of this effluent. Details are given of the populations colonizing immersed glass slides and of the seasonal cycle of *Cladophora*.

J.W.G. Lund.
Oct. 10th. 1955.

Annual Report of the Institute of Seaweed Research - 1954.

The report describes the activities of the Institute of Seaweed Research which has its headquarters at Inveresk, Midlothian. There is a scientific staff of over 20 and a total staff of over 50. Eight of the scientific staff, however, work at various University and Technical College departments on special problems.

As is to be expected, the major part of the report is concerned with work of potential commercial importance, such as harvesting and drying seaweeds, the production of algal chemicals and possible uses of raw material and manufactured products.

Of special interest to phycologists are the results of the surveys undertaken from chartered vessels in areas on both the east and west Scottish coasts. These appear to show that both the degree of cover and the total amount of seaweed has decreased very considerably in the period 1949-54. Since exploitation of the crop is presumably negligible so far, it will be most interesting to see future trends, how widely they extend and the possible causes.

Work at attached institutions includes that of Miss Kain at University College, London, who has grown *Porphyridium cruentum* in a 36-litre tank and is also studying *Asterionella japonica* and dinoflagellates in culture.

Among other interesting items are accounts of the bacterial decomposition of algae and the use of algae as a source of antibiotics and as a substrate for micro-organisms. The uptake of radio-active caesium and ruthenium is being studied; these are important as the major long-life constituents of radio-active waste. Caesium uptake has been found to depend closely on illumination.

The report lists some 26 papers published during the year and gives a short summary of each.

A.P. Orr.
June 20th. 1955.

RESEARCH ITEMS

A. REQUESTS FOR RESEARCH MATERIAL.

(1) **W. Eifion Jones**, at the Marine Biology Station, Menai Bridge, Anglesey would like to have specimens of *Gracilaria verrucosa*, preferably preserved in formalin-alcohol or as herbarium sheets, with some description of the habitat from which the specimen was obtained.

(2) **Hilda M. Lund**, at the Freshwater Biological Association, Ferry House, Faw Sawrey, Ambleside, Westmorland would like samples of phytoplankton, fresh or preserved in formalin, in relation to work on the distribution of chytrids and other fungi attacking these algae.

(3) **Richard C. Starr**, Department of Botany, Indiana University, Bloomington, Indiana, U.S.A. would like to have natural populations of desmids in which sexual reproduction is occurring. In sending such material, it is advisable that a small test tube (180 x 16 mm) be filled only about 1/2 to 2/3 full; it is best that the algal cells not be concentrated for shipment, but diluted with the natural medium in which they occur. A screw cap tube or a cork stopper should be used to prevent the escape of liquid. The material should be sent via air parcel post; most

desmids will survive the 1- to 2-week trip from the most distant points. Reimbursement for all expenses of packing and posting will be gladly made.

B. MICROCARD EDITIONS OF ALGAL CLASSICS.

Microprint will certainly play an increasingly important part in making scientific literature, and reference material in particular, more generally available. Members of the Society may be interested to know that the following algal classics are available on microcards from the Microcard Foundation, Middletown, Connecticut, U.S.A. (a non-profit-making organization):

AGARDH, J. G., *Species genera et ordines algarum ...*, 1848-63. 2 vol. (34 cards) $8.60.

KUETZING, F. T., *Phycologia Generalis ...*, 1843. (18 cards) $4.40.

KUETZING, F. T., *Species Algarum*, 1849. (18 cards) $4.40.

NAGELI, Karl W., *Gattungen einzelliger algen*, Physiologisch und systematisch, 1849. $2.20.

de TONI, G. B., *Sylloge algarum ...*, 1889-1924. 6 vol. (146 cards) $29.80.

Up to 80 pages are reproduced on the face of each 3 x 5 in. card. The cards can be filed in standard index card cabinets and a card can be consulted with a x 10 lens or more conveniently with a low power binocular microscope. Special readers are available for continuous reading at a cost of approximately £60 each but even at this price four readers could be bought for the difference in price between the microcard and the original editions of de Toni's *Sylloge*.

Phycologists might like to consider taking international action in getting other important, scarce, and expensive works on algae made available in this form.

G. C. Ainsworth.

BRITISH PHYCOLOGICAL SOCIETY
LIST OF MEMBERS (at 1st October 1955)

(with address, occupation and interests, compiled from Membership Application Forms).

Abbreviations as follows: **T**, teaching; **GR. S**, graduate student; **S**, student; **R**, research; **IND. B**, industrial biologist; **FW**, interested in freshwater algae; **M**, interested in marine algae; **XC**, willing to exchange collections or herbarium specimens; **XR**, willing to exchange reprints.

Please send corrections, additions, and notices of temporary or permanent changes of address to the Hon. Secretary.

A. - HONORARY MEMBERS.

COTTON, A. D., F.L.S.; 'Honey Cottage', Farnham Common, Bucks. M.

DELF, Dr E. Marion; 243 Haverstock Hill, London, N.W.3. M (especially Phaeophyta; ecology, structure & utilization). XR.

KNIGHT, Miss M., D.Sc., F.L.S.; 'Shee Dy Vea', Darragh, Port Erin, Isle of Man. M (especially Phaeophyta).

B. - ORDINARY MEMBERS.

AINSWORTH, G. C., Ph.D., F.L.S.; Department of Botany, Hatherley Laboratories, University College of the South West, Prince of Wales Road, Exeter, Devon. T. M.

AUSTIN, A. P., B.Sc.; 'Fairholme', Sea-View-Place, Aberystwyth, Cardiganshire. (At: Department of Botany, University College of Wales, Aberystwyth). GR.S. R. M (Gigartinales, especially autecology of *Furcelleria fastigiata* Lam.). XC (wanted: *Furcellaria fastigiata*, herb. or preserved). XR.

BAKER, Mrs K.M. DREW, D.Sc.; Department of Botany, University of Manchester, Manchester, 13. T.R. M & FW (Rhodophyta; cytology of Bangiales, *Rhodochorton* & *Batrachospermum*). XC (wanted: herbarium & fixed material of British spp. of Bangiales & *Batrachospermum*). XR.

BALLANTINE, Miss D., B.Sc.; The Laboratory, Citadel Hill, Plymouth, Devon. R. M (flagellates & other algae). XR.

BARRON, H., B.Sc.; Department of Botany, Queen's University, Belfast, Northern Ireland. T.R. M (ecology: epiphytes of *Laminaria spp.*; diatoms). XR.

BELCHER, J. H., B.Sc.; 197 Risley Avenue, Tottenham, London, N.17. (At: Department of Botany, University College, London). GR.S. R. FW (physiology & ecology). XR.

BEXON, Miss D., M.Sc., F.L.S.; Department of Botany, The University, University Park, Nottingham. T. (Chlorophyta).

BLACKLER, Miss H., Ph.D., F.L.S.; The Gatty Marine Laboratory, The University, St. Andrews, Fife. T.R. M (ecology; Phaeophyta). XR.

BOALCH, G. T.; 'Westfield', Beer, Nr. Seaton, Devon. (At: Department of Botany, University College, London). GR.S. M (ecology).

BURNETT, Professor J. H., M.A., D.Phil.; Department of Botany, The University, St. Andrews, Fife. T. R. (Carbohydrate metabolism of algae. Genetics and reproduction). XR (on appropriate topics).

BURROWS, Mrs E. M., Ph.D.; The Hartley Botanical Laboratories, University of Liverpool, Liverpool, 3. T.R. M (ecology, especially of Fucaceae & Corallinaceae). XR.

BUTCHER, R. W., Ph.D., F.L.S.; Fisheries Laboratory, Burnham-on-Crouch, Essex. R. M & FW (Euryhaline microphytes). XR.

CAMPION, Miss M., B.Sc.; Department of Zoology, The University, Reading, Berkshire. R. FW (Chlorophyta, particularly epiphytic spp.).

CARTER, Miss N., D.Sc.; 23 Mountside, Guildford, Surrey. (At: Guildford Technical College). T. FW. XR.

CHALKLIN, Miss K. M., M.Sc.; Department of Botany, University Science Laboratories, South Road, Durham. T.R. FW (algae of small ponds). XC. XR.

CHAMBERLAIN, Miss Yvonne M., B.Sc.; Department of Botany, British Museum (Natural History), Cromwell Road, London, S.W.7. R. M.

CHIU, Miss B. T., B.Sc.; Department of Botany, The University, Hong Kong, East Asia. T. R. M. XR.

CHONCHUBHAIR, Miss M. N., B.Sc.; Department of Botany, University College, Galway, Co. Galway, Ireland. R.M.

CHRISTIANSON, Mrs Iona G. (née MACLENNAN), M.Sc.; C/o Department of Botany, University of Melbourne, Carlton, Victoria, Australia. T. R. M (Antarctic spp.). XR.

CLAY, Miss E., M.Sc.; 'Green Hollow', Gattery Lane, Higher Brixham, Brixham, S. Devon. (At: I.C.I. Marine Laboratory, Brixham). R. M (culture).

CONWAY, Mrs E., Ph.D.; Department of Botany, The University, Glasgow, W.2. T.R. M (ecology & taxonomy). XR.

CRIBB, A. B., M.Sc.; Department of Botany, University of Queensland, Brisbane, Queensland, Australia. T.R. M (taxonomy & ecology). XC. XR.

DAVENPORT, Miss E., B.Sc.; 3 Sheldon Avenue, Vicars Cross, Chester. (At: Department of Botany, University of Liverpool, Liverpool, 3). GR.S. R. FW (ecology). XC.

DAVEY, Miss A. J.; 20 Deiniol Road, Bangor, Caernarvonshire, North Wales. M.

DICKINSON, Miss C. I., M.A.; The Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey. R. M (taxonomy).

DIXON, P. S., M.Sc., Ph.D.; The Hartley Botanical Laboratories, University of Liverpool, Liverpool, 3. T.R. M (Rhodophyta; cytology). XC (Gelidiales & Nemalionales).

DOUGLAS, Miss B., B.Sc.; Freshwater Biological Association, The Ferry House, Far Sawrey, Ambleside, Westmorland. R. FW.

DROOP, M. R., Ph.D.; Marine Station, Millport, Isle of Cumbrae, Scotland. R. M (ecology & physiology of flagellates). XR.

DUNN, Miss M. D., Ph.D.; Department of Botany, The University, St. Andrews, Fife. T.M.

ETCHEVERRY, Dr H.; Estacion de biologia marina, Universidad de Chile, Casilla 13D, Vina del Mar, Chile. T.R. M (ecology, taxonomy & utilization). XC. XR.

ETHERINGTON, Mrs Joy (née KERSLAKE), B.Sc.; 1 St John's Gardens, London, W.11. (At: Department of Biology, Northern Polytechnic, Holloway Road, London, N.7). T.R. M (*Ectocarpus*). XC (wanted: British *Ectocarpus spp.*).

EVANS, J. H., B.Sc.; 2 Dorset Road, Harrow, Middlesex. (At: Department of Botany, Royal Holloway College, Englefield Green, Surrey). GR.S. R. FW.

FELDMANN, Professor J.; Faculté des Sciences, Institut Océanographique, 195 rue Saint Jacques, Paris 5^{e}, France. T.R. M (morphology, cytology & taxonomy of marine algae, particularly those of the coasts of France & the Mediterranean).

FOGG, Dr G. E.; Department of Botany, University College, Gower Street, London, W.C.1. T. R (algal physiology & biochemistry). XR.

FORD, Miss V. E., B.Sc.; 43 Woodbourne Avenue, Brighton, Sussex. T. M (ecology).

FOX, Miss M. E., B.Sc.; Department of Botany, University College, Ibadan, Nigeria, West Africa. (During July, Aug. & Sept. at: 38 Welwyn Park Road, Hull, E. Yorks). T. M (algal flora of Nigeria & Britain). XC (especially genus *Gracilaria)*. XR.

GEORGE, E. A., M.A.; The Culture Collection of Algae & Protozoa, The Botany School, Downing Street, Cambridge. (Curator of The Culture Collection). T.R. FW (all aspects of culture; morphology & taxonomy). XC (living material only). XR.

GODWARD, Miss M. B. E., Ph.D.; Department of Botany, Queen Mary College, Mile End Road, London, E.1. T.R. FW (cytology & cytotaxonomy especially of *Spirogyra* & other Conjugales; ecology). XC (exsiccata of *Spirogyra* will be available for similar exchange in due course). XR.

GREIG-SMITH, Mrs E.; 'Gwyndy', Menai Bridge, Anglesey, North Wales. M.

HARE, Miss M. P., B.Sc.; 'Crooklands', Badminton Road, Old Sodbury, Nr. Bristol. (At: The University, Reading). R. FW (Ulotrichales).

HARRIS, Mrs K., B.Sc.; 47 Elm Road, Earley, Reading, Berkshire. FW (Chrysophyta). XR.

HARRIS, R. E., M.S.A.; Applied Biology Laboratory, National Research Council, Ottawa, 2, Canada. R. M (cytology). XC (wanted: British *Callithamnion spp.)*. XR.

HARTSHORNE, J. N., B.Sc.; Department of Botany, University of Manchester, Manchester, 13. T. R (Chlorophyta, especially cell wall structure and genetics). XR.

HARWOOD, Mrs M.G. (née WARREN), B.Sc.; 17 Plaistow Lane, Bromley, Kent. FW.

HENDEY, N. I., F.L.S.; Central Metallurgical Laboratory, Emsworth House, Havant Road, Emsworth, Hampshire. R. M (diatoms). XC (by prior arrangement). XR.

HOFFMANN, Professor Dr C.; Institut für Meereskunde der Universität Kiel, Botanische Abteilung, Hohenbergstr 2, Kiel, Germany. T.R. M (physiology & ecology). XC. XR.

HUNTER, Miss E. I., M.Sc.; 57 Val Plaisant, St Helier, Jersey, Channel Islands. T.R. FW (ecology).

IRVINE, D. E. G., Ph.D.; 21 Cranmer Road, Cambridge. (At: School of Agriculture, University of Cambridge). R. M (ecology of rock pools).

IRVINE, Mrs Linda M. (née NEWTON), B.Sc.; 21 Cranmer Road, Cambridge. R. M & FW (taxonomy, especially of marine algae). XR.

IRWIN, Miss A. M.; 'Bayhead', Port Ballantrae, Bushmills, Co. Antrim, Northern Ireland. M. XC.

ISAAC, Professor W.E.; Department of Botany, University of Cape Town, Cape Town, South Africa. (Also, until 1st February 1956 - C/o Barclay's Bank, 1 Cockspur Street, London, S.W.1). T.R. M (ecology & distribution of South African marine algae). XR.

JONES, W. E., B.Sc.; Marine Biological Station, University College of North Wales, Menai Bridge, Anglesey, North Wales. R. M (ecology & physiology).

KAIN, Miss J. M., B.Sc.; 11 Acol Road, London, N.W.6. (At: University College, London). R. M (algal culture).

KEARNEY, Miss K. N.; 7 Orpen Avenue, Finaghy, Belfast, Northern Ireland. (At: Department of Botany, Queen's University, Belfast, Northern Ireland). S. M (ecology).

KERR, Miss H. G., B.Sc.; 'Cranstoun Lodge', Ladies' Walk, Stranraer, Wigtownshire, Scotland. (At: Glasgow University, & Marine Station, Millport). GR.S. R. M (supralittoral ecology, especially Cyanophyta).

KING, G. C., Ph.D.; Department of Botany, Queen Mary College, Mile End Road, London, E.1. R. FW (cytology & ecology). XC (culture collections only). XR.

KIPLING, Mrs Brenda M. (née KNUDSON), B.Sc.; C/o Freshwater Biological Association, The Ferry House, Far Sawrey, Ambleside, Westmorland. R. FW (plankton algae, especially genus *Tabellaria*). XR.

KORNMANN, Professor Dr P.; Biologische Anstalt Helgoland, List/Sylt, North Frisian Islands, Germany. R. M (reproduction). XR.

KOSTER, Dr Joséphine Th.; Rijksherbarium, Nonnensteeg 1, Leiden, Netherlands. R. M & FW (taxonomy, especially of Cyanophyta). XC. XR.

KYLIN, Mrs E., Fil. mag.; Stora Sodergatan 4, Lund, Sweden. R. M & FW (Rhodophyta). XR.

LACEY, A. J., B.Sc.; Department of Botany, King's College, Newcastle-upon-Tyne, 1. GR.S. R. M (ecology).

LAWSON, G. W., Ph.D.; Department of Botany, University College of the Gold Coast, Achimota, Gold Coast, West Africa. T.R. M (ecology). XC. XR.

LEVRING, Dr T.; Marinbotaniska Institutionen, Botaniska Trädgarden, Göteborg, Sweden. T.R. M (taxonomy, morphology, ecology, physiology). XC. XR.

LEWIS, J. R., Ph.D.; Department of Zoology, The University, Leeds, 2, W. Yorks. T.R. M (ecology and geographical distribution). XR.

LIND, Miss E. M., Ph.D.; P.O. Box 262, Makerere College, Kampala, Uganda, Africa. T.R. FW (plankton: ecology & taxonomy). XR.

LUND, Mrs Hilda M. (née CANTER), Ph.D.; Freshwater Biological Association, The Ferry House, Far Sawrey, Ambleside, Westmorland. R. FW (Phycomycetes parasitic or saprophytic on algae). XC (wanted: plankton samples preserved in formalin).

LUND, J. W. G., M.Sc., Ph.D.; Freshwater Biological Association, The Ferry House, Far Sawrey, Ambleside, Westmorland. R. FW.

MADGE, Miss M. A. P., Ph.D.; Department of Botany, Royal Holloway College, Englefield Green, Surrey. T.R. M & FW (Chlorophyta). XC. XR.

MARTIN, Miss M. T., Ph.D., F.L.S.; University Hall, Bangor, Caernarvonshire, North Wales. T.R. M (Rhodophyta: especially parasitic Florideae). XC (wanted: material of any parasitic algae). XR.

MOSS, Miss B., M.Sc., Ph.D., F.L.S.; Department of Botany, King's College, Newcastle-upon-Tyne, 1. T.R. M (Phaeophyta: biochemistry & cytology). XR.

NAYLOR, Miss M., Ph.D.; Department of Botany, University of Hull, Hull, E. Yorks. T.R. M (life-histories & cytology of Phaeophyta).

NELSON, Mrs Sheila M. (née LODGE), Ph.D.; 18 Willowbank Road, New Ferry, Wirral, Cheshire. M (ecology). XR.

NEWTON, Professor Lily, D.Sc., Ph.D., F.L.S.; Department of Botany, University College of Wales, Aberystwyth, Cardiganshire. T.R. M (seaweed utilization and the algae concerned). XR.

NICOLAI, Dr M. F. Emilie; Department of Botany, The University, Leeds, 2, W. Yorks. T.R. M & FW (anatomy & physiology). XR.

PARKE, Miss M. W., D.Sc., Ph.D., F.L.S.; The Laboratory, Citadel Hill, Plymouth, Devon. R. M. XR.

PARKES, Miss H. M., M.Sc.; 52 Leeson Park, Dublin, Ireland. (At: Trinity College, Dublin). R. M (ecology & reproduction). XC (algae from the coast of Co. Dublin). XR.

POWELL, H. T., B.Sc.; Marine Station, Millport, Isle of Cumbrae, Scotland. R. M (ecology & taxonomy). XC (wanted: all forms of *Fucus inflatus* L., herb. or preserved). XR.

PROWSE, G. A., Ph.D.; C/o Department of Botany, University of Malaya, Singapore, Malaya. T.R. FW (plankton). XC. XR.

RAO, C. S. P., M.Sc.; Department of Botany, Banaras Hindu University, Banaras, United Provinces, India. T.R. M (cytology & life-histories). XR.

RICHARDSON, W. D., B.Sc.; Institute of Seaweed Research, Inveresk, Musselburgh, Midlothian. R. M (sublittoral surveying).

ROSS, R., M.A.; Department of Botany, British Museum (Natural History), Cromwell Road, London, S.W.7. R (Diatomaceae, particularly taxonomy).

ROUND, F. E., Ph.D.; Department of Botany, University of Bristol, Bristol, 8.. T. FW. XR.

SELBY, C. H., B.Sc.; Department of Botany, Queen Mary College, Mile End Road, London, E.1. GR.S. R. FW (cytology & ecology).

SINCLAIR, J., B.Sc.; Curator of Herbarium, Botanic Gardens, Singapore, Malaya. R. M. XC. XR.

SINGH, R. N., D.Sc.; Department of Botany, Banaras Hindu University, Banaras, United Provinces, India. T.R. FW & subaerial (Cyanophyta & Chlorophyta). XC. XR.

SMAGT, Miss J. V. van der, B.Sc.; 72 Balham Park Road, London, S.W.12. (At: Department of Botany, Queen Mary College, Mile End Road, London, E.1). GR.S. R. FW (ecology).

SMITH, G. G., M.Sc.; Department of Botany, University of Western Australia, Nedlands, Western Australia. (At: Department of Botany, University College of Wales, Aberystwyth - until January 1956 only). T.R. M (algal & saltmarsh ecology). XC (will exchange Western Australian algae, especially Siphonales & Siphonocladiales, for Laminariales of any country). XR.

SMITH, I.; Courtauld Institute of Biochemistry, The Middlesex Hospital, Medical School, London, W.1. T. R. M & FW (biochemistry of algae; chromatographic analysis of nitrogen compounds, especially amino-acids). XR.

SPEARING, J. K., Ph.D.; 'Lindeth', 59A Hitchen Hatch Lane, Sevenoaks, Kent. (At: Sir John Cass College, Jewry Street, Aldgate, London, E.C.3). T. FW & M (cytology, especially of Cyanophyta).

SREERAMULU, T., M.Sc.; Department of Botany, Andhrar University, Waltair, India. (At: Department of Botany, Imperial College, Prince Consort Road, London, S.W.7). T. R. FW & M. XC. XR.

STANBURY, Miss F. A., M.Sc., F.L.S.; 'Slieve Bloom', Willoway Park, Yelverton, South Devon. (At: Plymouth & Devonport Technical College, Tavistock Road, Plymouth, Devon). T.R. M (ecology: Cladophoraceae; diatoms). XC (particularly Cladophoraceae). XR.

TALLING, J. F., B.Sc.; Department of Botany, The University, Leeds, 2. W. Yorks. R. FW (plankton, physiology).

TAYLOR, Professor W. R., M.S., Ph.D.; Department of Botany, University of Michigan, Ann Arbor, Michigan, U.S.A. T.R. M (tropical & North Atlantic) & FW (particularly desmids & Rhodophyta). XC (marine, particularly tropical, by pre-arrangement). XR.

THOMAS, Miss E. M., B.Sc.; 'Hillside', Eden Avenue, Swansea, Glamorgan. (At: Cheltenham Ladies' College). T. M (ecology & Rhodophyta).

TULEY, P., B.Sc.; Department of Agriculture, Eastern Province, Nigeria, West Africa.

TWEED, R. D.; 'Shermoor', St George's Drive, Deganwy, N. Wales. (At: University College of North Wales, Bangor). R. FW (algae of Sierra Leone & Newfoundland). XR.

de **VALÉRA**, Miss M., M.Sc., Ph.D.; Department of Botany, University College, Galway, Co. Galway, Ireland. T.R. M (ecology & distribution, particularly of Rhodophyta, on Irish west coast). XC (especially Rhodophyta). XR.

WAERN, Dr M.; Sysslomansgatan 9, Uppsala, Sweden. (At: Växtbiologiska Institutionen, Uppsala Universitet). T. R. M & FW (especially benthic algae of brackish-water; taxonomy, ecology & geographical distribution). XC. XR.

WALKER, F. T., B.Sc., F.L.S.; Institute of Seaweed Research, Inveresk, Musselburgh, Midlothian. R. M (ecology & sublittoral surveying). XC. XR.

WILLIAMS, Professor W. T., A.R.C.S., Ph.D., D.I.C., F.L.S.; Department of Botany, University College, Southampton. T. R (physiology: especially growth studies).

WILSON, Mrs M. A., M.Sc., Ph.D.; 49 Torland Road, Hartley, Plymouth, Devon. M (general, & history of phycology).

WOODHEAD, N., M.Sc., F.L.S.; 22 Deiniol Road, Bangor, Caernarvonshire, N. Wales. (At: Department of Botany, University College of North Wales, Bangor, N. Wales). T. FW (taxonomy & ecology). XR.

H.T. Powell, Hon. Secretary.